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ATION

TECHNOLOGY DEPARTMENT

First Copy

September
1931

Construction Methods

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SEP 24 1931
DETROIT

Whitcomb Bridge, Pittsburgh,
the two-rib arches, with record
main span of 460 ft.

A MONTHLY REVIEW OF FIELD PRACTICE AND EQUIPMENT

General Construction · Highways · Buildings · Engineering · Industrial

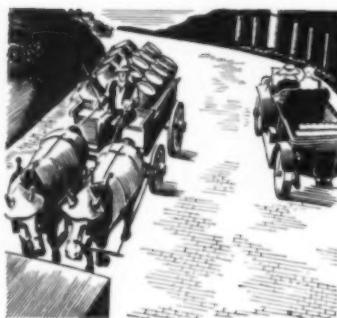
21 Years

On the Mohawk Trail



Present condition of Brick Pavement Route 5 west of St. Johnsville.

THE Mohawk Trail — main artery of travel between Albany, Syracuse and Buffalo — is a real test for any paving material. The traffic is extremely heavy and the volume large. ♦♦ In 1910 the New York State Highway Department let the contract for 3.73 miles of pavement between East Creek and St. Johnsville. This was to be a test strip. Brick and two other types of materials were selected. Construction was begun in 1910 and completed in 1912. ♦♦ Today only the brick remains. One type of material has been taken up and the section repaved. The other was covered in 1915. ♦♦ The brick surfaced pavement is



still in practically perfect condition. — And as for maintenance expense — the records of the New York Department of Public Works show that it has averaged $\frac{3}{5}$ of a cent per square yard — or about 5% of the maintenance expense required by

the other test section on which records were kept. ♦♦ It is authentic records of performance such as this which are winning new friends for brick each year.

THE METROPOLITAN PAVING BRICK CO. CANTON, OHIO

Manufacturers of Metro Canton, Cleveland, Bessemer and Olean Paving Block . . Architectural Face Brick and Metro Trickling Filter Flooring

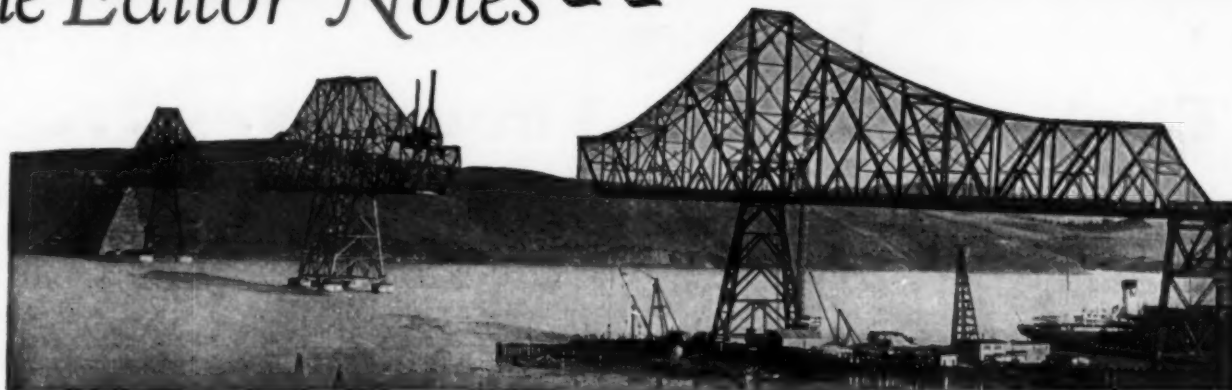
BRICK PAVEMENTS

CONSTRUCTION METHODS, September, 1931, Vol. 13, No. 9. Published monthly. McGraw-Hill Publishing Company, Inc., Tenth Avenue at Thirty-sixth Street, New York, N. Y. \$1 per year; 10 cents per copy. Entered as second-class matter, October, 1926 issue, Vol. 8, No. 19, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

TECHNOLOGY DEPT

September, 1931—CONSTRUCTION METHODS

The Editor Notes --



Methods of Curing Concrete Pavements

IN THESE days the construction of a concrete pavement moves ahead so rapidly, and so much more is put down in a day or a week than was the case just a short time ago, that the problem of obtaining adequate curing of the concrete has taken on new aspects. Although most highway engineers still think that the most favorable curing condition exists when the slab is kept damp during the curing period by means of a wet covering of earth, sand, hay, straw, etc., sometimes practical difficulties arise that make other methods appear attractive. Difficulty in providing an adequate water supply for keeping some two miles of cover properly wet, difficulty in obtaining thorough compliance with the specifications so far behind the crew, and lack of opportunity to inspect the finished work, are some of the factors that have opened the way to the use of other methods.

For two years a special committee of the Highway Research Board has been studying curing of concrete and gathering facts concerning the more extensively used methods. A review of the available data is presented in the progress report of this committee in the Tenth Annual Proceedings of the board.

Although research studies have not yet progressed to a point where definite standards of comparison for different curing methods can be set up, considerable information is available on strength, surface condition and volume change, all of which give some indication of curing qualities.

Surface applications of calcium chloride in regions where the air temperature and humidity are such that the salt will readily dissolve, according to R. W. Crum, director of the board, have been found to produce concrete 90 per cent or more as strong as concrete cured with a wet cover, with no greater changes in volume. This

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, Editor

Editorial Staff

VINCENT B. SMITH NELLE FITZGERALD
J. I. BALLARD (San Francisco)

WILLARD CHEVALIER, Publishing Director

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Tenth Avenue at 36th Street, New York

method has not been found to be a primary cause of surface scaling in appreciable amounts.

Concrete cured with bituminous coatings in general showed strength 90 per cent or more of that of wet cured concrete. Volume changes as evidenced by temperature ranges, direct measurement and crack surveys are greater, indicating that more frequent shrinkage cracks are to be expected unless prevented by proper joint spacing. Coating the bituminous covered surface as soon as possible with some light colored material, such as whitewash, appears to decrease the volume changes.

Big Output From Dragline

An impressive yardage of earth moved by dragline during one month is reported by Ulen & Co. on its \$6,000,000 irrigation and power project in Maverick County, Texas. During 31 days in January a 240-hp. diesel-powered dragline, with 6-yd. bucket and 120-ft. boom, excavated 247,000 cu.yd. of silty loam and gravel on the Trinity Farm project. The run was made through a 25-ft. cut, from which earth was spoiled 200 ft. from the center line. In comparing this output with some of the high dragline yardages moved on levee-building work along the Mississippi River, it is well to recall that on the Texas project the cut made by the dragline bucket was not limited to the comparatively shallow borrow-pit cuts required on the Mississippi work.

Largest Concrete Arch in the United States

WHAT will be the longest reinforced concrete arch in the United States is under construction for the George Westinghouse bridge at East Pittsburgh, Pa., a five-arch structure, 1,500 ft. long with the span of the central arch measuring 460 ft. between pier centers. As described in this issue, the methods and the equipment being used by the Booth & Flinn Co., the contractors building the structure for Allegheny County, are of particular interest to the construction man.

Crossing Turtle Creek valley at a high level the long structure, involving the placement of a large yardage of concrete, offered opportunity for effective use of a three-track tower cableway with a span of 1,650 ft. between head and tail towers for handling forms and centering and delivering concrete.

Of primary interest, of course, are the details of steel centering and forms, especially for the record-breaking main arch span. Each of the five bridge spans consists of two arch ribs, spaced 32 ft. apart on centers so that the lateral shifting of the heavy trussed centering from one rib to the other, after the first pour of concrete had cured, presented interesting field methods.

For the main arch span of 460 ft. between piers a pair of tall structural steel and timber towers had to be set up to carry the centering. For all forms watertightness was an essential insisted on by the contractor and tongue-and-groove lumber was employed to obtain that result.

Equipment Replacement

In every depression Andrew Carnegie, it is said, got his plants ready for the next period of business activity by junking and replacing out-of-date equipment.

They Speak for Themselves . . .

July 1—A Reader Asks:

"On page 39 of the June 1931 issue of *Construction Methods* the writer notes that the August number will contain a portrayal of the methods used in making multiple-main river crossings with large gas transmission mains.

"Would it be possible for you to furnish an advance copy of the written matter to accompany

this article so that the writer could have the benefit of it within the next few days?

"If the cost for this series is greater than the usual charge for making photostatic prints, will you kindly advise the writer so that we can send a formal order?"

July 6—The Editor Answers:

"With this letter I am mailing to you a revised copy of the text for our article on the construction of a submerged river crossing for a large gas transmission main. After you have completed your use of this copy, I wish you would return it to me. You may keep the material as long as you need it.

"If I can give you any further assistance on the subject of river crossings, please be sure to call upon me."

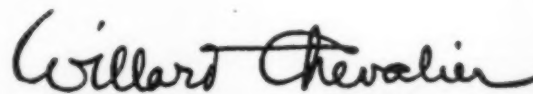
July 7—The Reader Acknowledges:

"As per your request we are returning herewith advance copy of the article relative to submarine gas pipe river crossing which is to appear in the August issue of *Construction Methods*. We have had copies of this article made for our use.

We appreciate very much this service that you have given to us as one of your subscribers, and we thank you for the prompt response which you made to our request.

"As you probably know, we constructed a very interesting river crossing last year. We are now contemplating the construction of another river crossing, but this time in water up to 70 ft. deep. If you happen to run across any other descriptions of ingenious construction methods suitable for this purpose, we would be glad to have you let us know about them."

All of which shows rather clearly how the readers of CONSTRUCTION METHODS—
Well, why not let the letters speak for themselves?



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Tramway carrying 220 tons hourly of sand and gravel for the construction of the Pardee Dam in California. Built for the contractors—Atkinson Construction Co.

Locked Coil Trade Cable used on American Steel & Wire Tramways.

AMERICAN

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Aerial TRAMWAYS

This system provides an economical and dependable method of transporting material in every kind of country—over mountains, valleys, and rivers; to and from locations entirely inaccessible by surface routes.

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1831



1931

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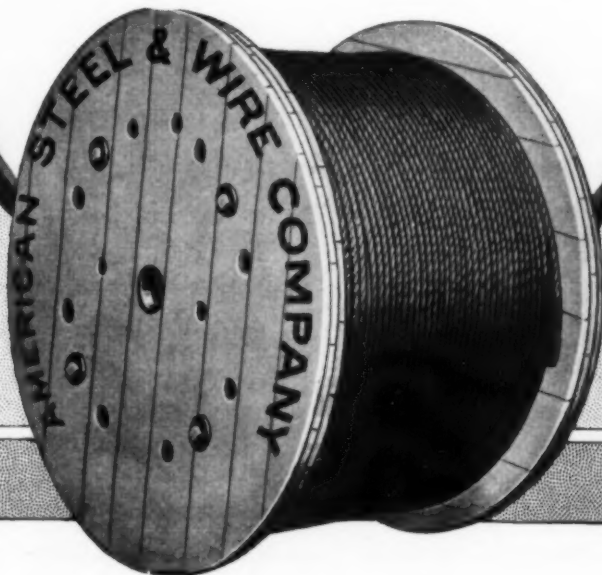
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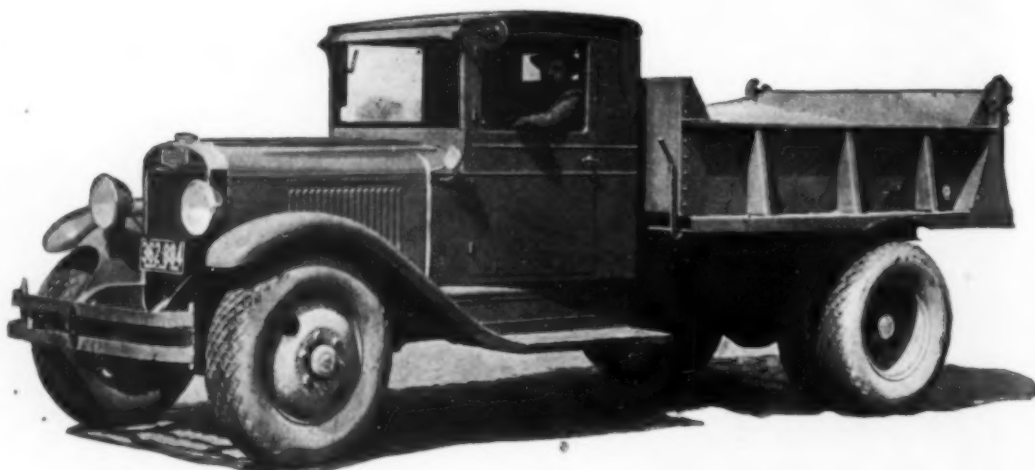
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MANUFACTURERS
OF WIRE ROPE
IN THE WORLD

One of a fleet of Autocars recently purchased by O. T. Harlow, Mt. Ranier, Md., who began buying Autocars nine years ago. In busy times, Mr. Harlow often drives a truck himself. He knows his equipment personally—as it operates on the job and as it appears on the books. That's why he continues to buy Autocars. Complete specifications of the Model D illustrated may be had by writing The Autocar Company, Ardmore, Pa.



AUTOCARS HAULED 2,500,000 BRICKS FOR THE NEW DEPARTMENT OF AGRICULTURE BUILDING

Two million dollars of the \$250,000,000 Federal building program has been spent to erect a new Department of Agriculture building. The old quarters had become obsolete. They were out-of-date. There was not sufficient room to house the department's many bureaus. The new building is modern. Despite its cost, it will be economical, for it will soon pay for itself by increasing the efficiency of the department.

There is nothing obsolete about the modern line of Autocar trucks. They're modern. They're efficient. They're profitable. That's why the fleet of Autocars owned by O. T. Harlow, Mt. Ranier, Md., hauled 2½ million bricks and all the sand used in the new Department of Agriculture building.

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TRUCKS
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A LAME DUCK -



OR A NORTHWEST?

WHAT'S your choice? Easy mobility that negotiates all ground conditions or "lame duck" action that "limps" around the curves on one live crawler.

The Northwest gives you positive traction—full power on both crawlers even when turning. It brings you $2\frac{1}{2}$ times the travelling power on the turns when you need traction most.

Compare this with the inefficient "block and skid" method where all the power and strain is thrown on one crawler that must force the massive dead weight of the other over or through the earth's crust to turn it.

Ask yourself which is the right way to steer a shovel. You need this mobility and once you have it you will wonder how you got along without it. Why not ask about it?

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5



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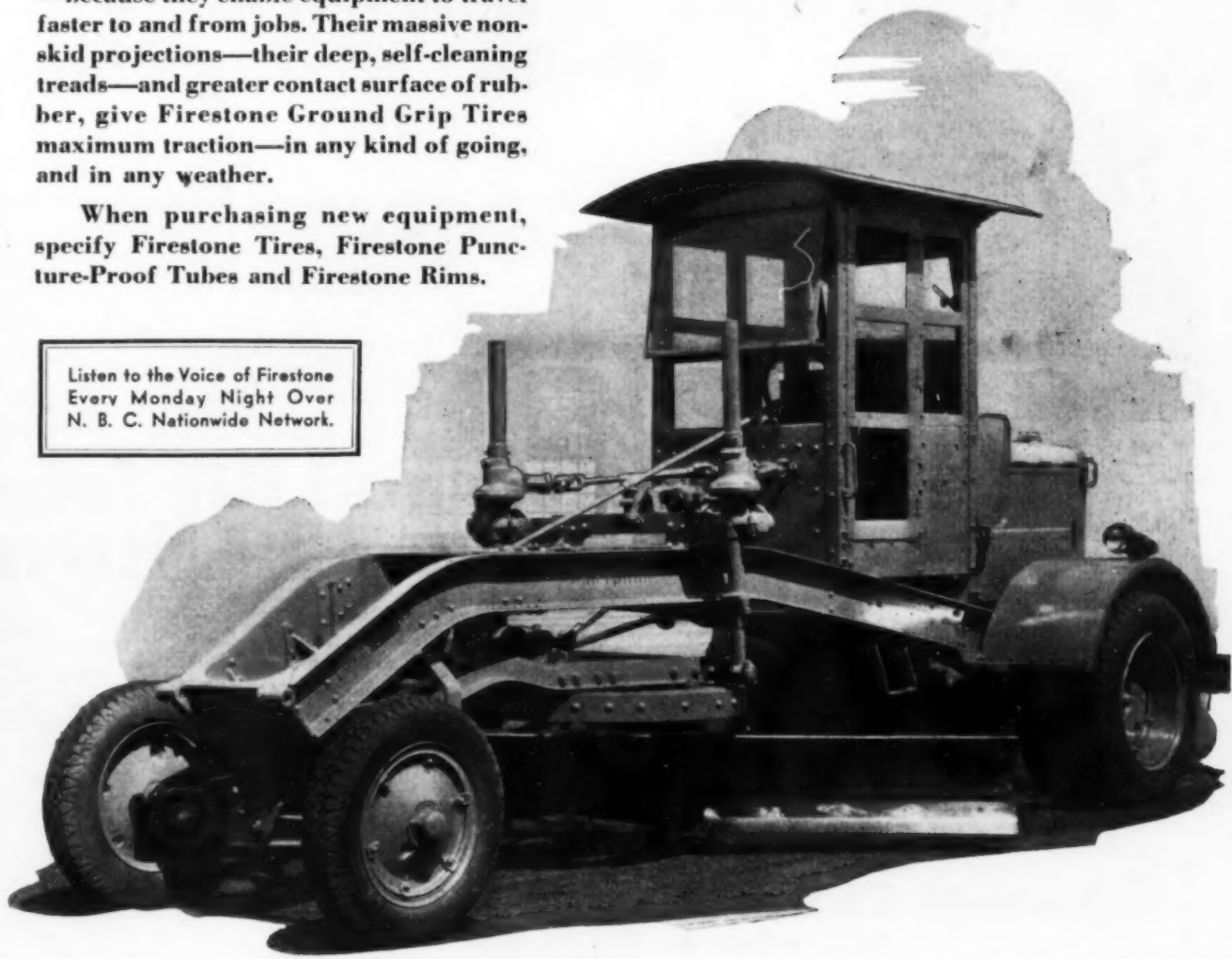
Use Firestone

MUCH of the money you make this year will be the money you save, and the elimination of excessive wear and tear on your equipment is one of the best ways to lower operating costs. Firestone Ground Grip Tires provide extra cushioning that keeps road graders and tractors out of the repair shop.

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Every Monday Night Over
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60

Ransome

BIG MIXERS

**selected for 38
Central Mixing Plants**



Ransome three yard mixer in the plant of T. L. Herbert & Sons, Nashville, Tenn.

HERE is the list of the various sizes that have been selected by prominent owners of Central Mixing Plants:

13-1 yard Ransome Mixers	
8-1½ " " "	
18-2 " " "	
20-3 " " "	
1-4½ " " Mixer	

Big Operators and Big Jobs demand *Ransome* Big Mixers

and three Big Reasons guided their choice:

RANSOME BIG MIXERS—

1. Mix highest quality concrete
2. Discharge fast and clean
3. Cost least to maintain

and the Ransome Spiral Cut-off Water Tank gives *quick and accurate* control.

The mixer is the heart of the Central Mixing Plant. Before you select a mixer visit the plants now in operation and see what mixers are best serving the field.

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New Jersey



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7/8
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1-1/2
1-3/4
2
2-1/4
2-1/2
3
3-1/2
4
4-1/2
5 and up to 16 yards

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Drag-lines

Clam-shells

Lifting Cranes

Drag-shovels

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Drag-line Buckets

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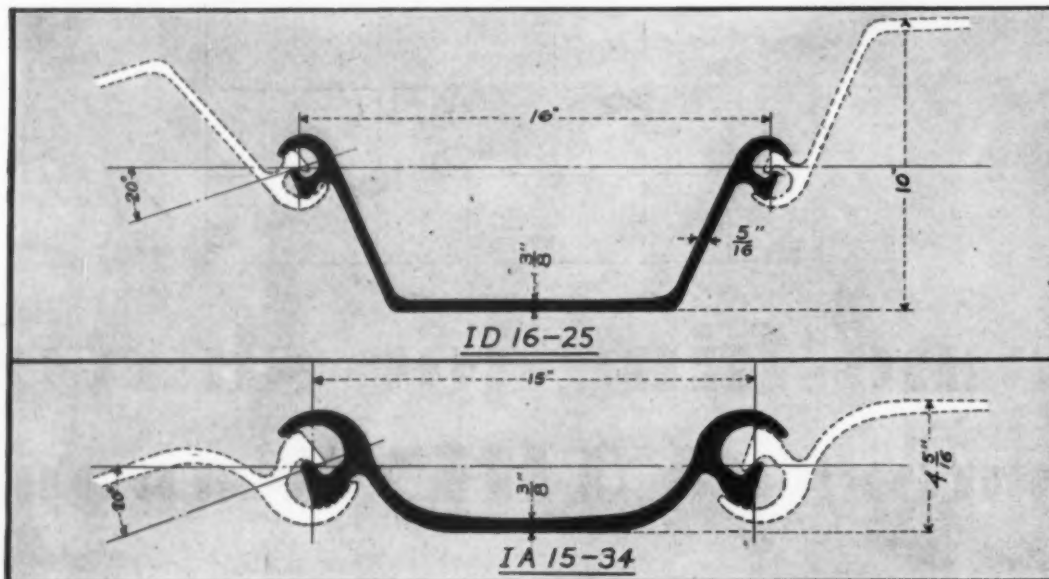
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The two sections, ID 16-25 and IA 15-34, shown in the accompanying diagrams, are now being produced. Other sections will follow so that, in the near future, the line of Inland Steel Sheet Piling will be complete.

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This 495 foot span is the longest in the United States

BLAW-KNOX *Steel Centering*



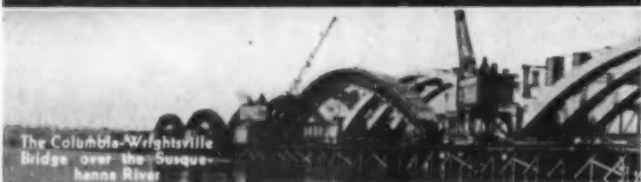
The Jacks Run Bridge in
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built with Blaw-Knox
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The Juniata
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The Harlan River Bridge



The Columbia-Wrightsville
Bridge over the Susque-
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BLAW-KNOX STEEL CENTERING played a prominent part in the construction of these marvelous Lincoln Highway Bridges.

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Thousands of other contractors throughout the world know that it pays to obtain a Blaw-Knox engineering opinion before any work is begun.

Call for Blaw-Knox engineering advice on the use of steel forms for concrete jobs of any kind—it costs you nothing and perhaps may be worth a great deal.

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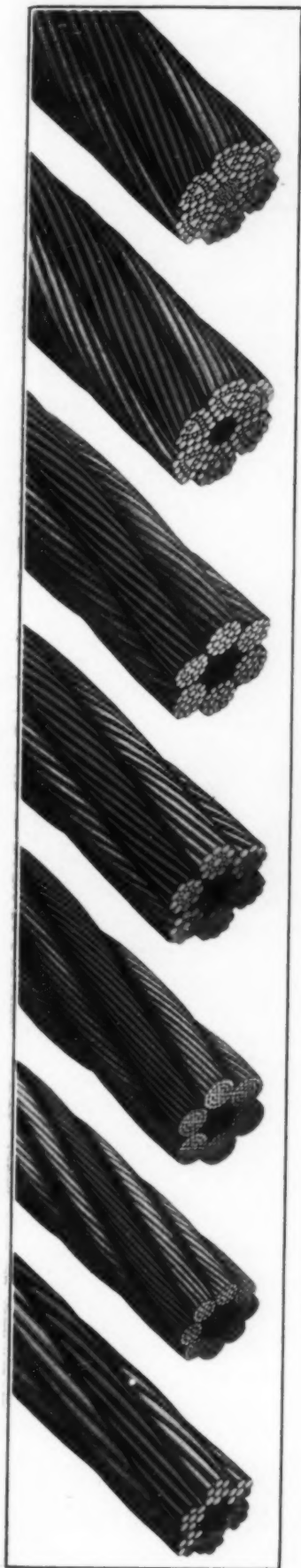
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**Are You Using the Kind of Rope Best
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HEAVERY loads, high speeds, sharp bends, sudden jerks, severe wear—these are only a few of the conditions that a wire rope encounters during the day's work.

—And if best results are to be obtained a wire rope must not only be of the right quality, but it also must be of the right construction to fit the conditions under which it is to operate.

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If you are not satisfied with the results you are getting from your wire rope, it may be that you are not using the correct construction. We would be glad to help you select the right rope for your particular conditions. Please feel free to write us. Our Engineering Department is at your service.



Made Only by **A. Leschen & Sons Rope Co.** Established 1857

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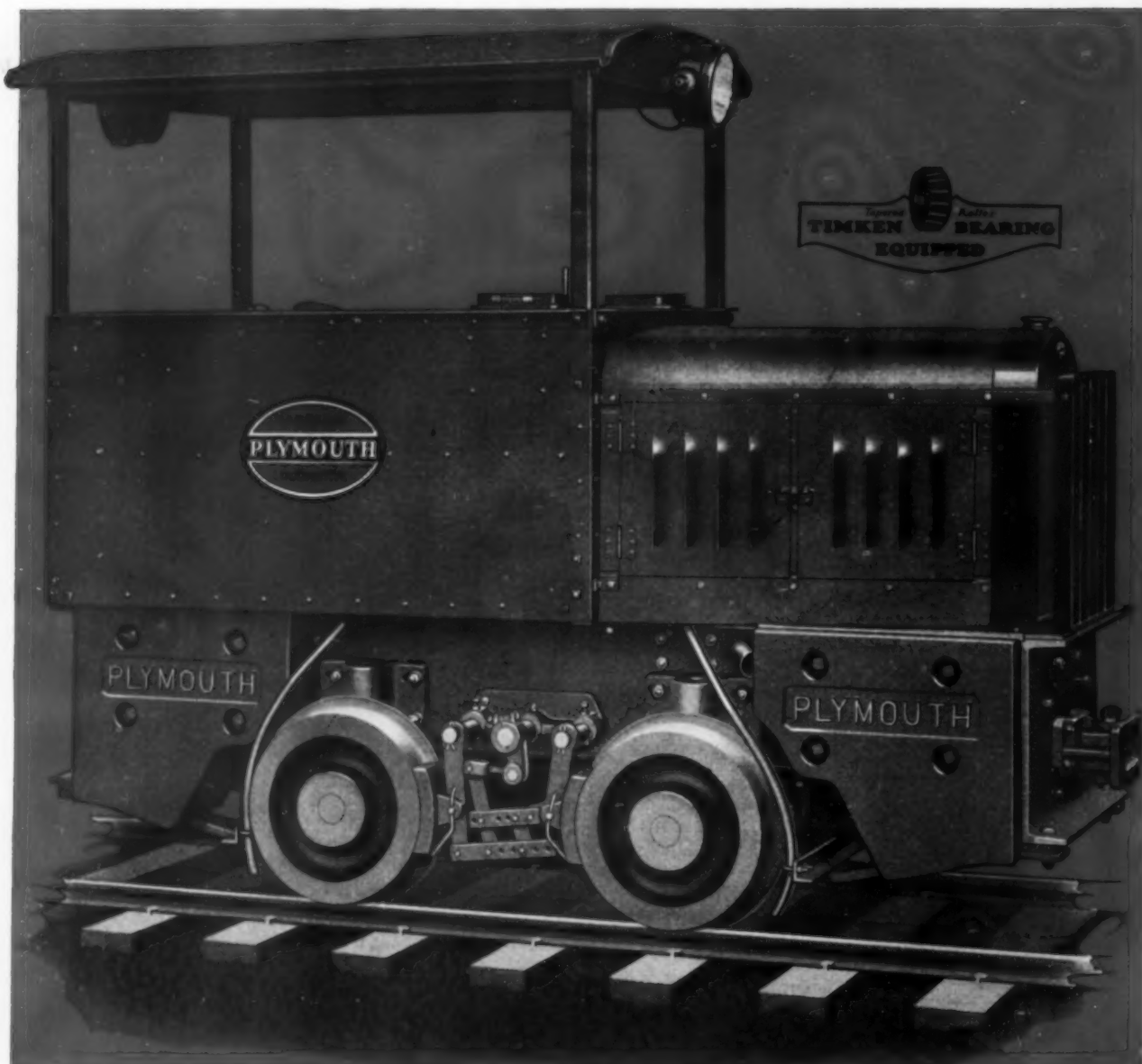
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A real locomotive, designed for locomotive service.

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Ruggedly, to withstand severe usage.

Compactly, for use in restricted areas.

With short wheel base to negotiate sharp curves.

With 4 Speeds forward or reverse—through Plymouth Reverse Transmission.

And with abundant power to pick up its load and "go".

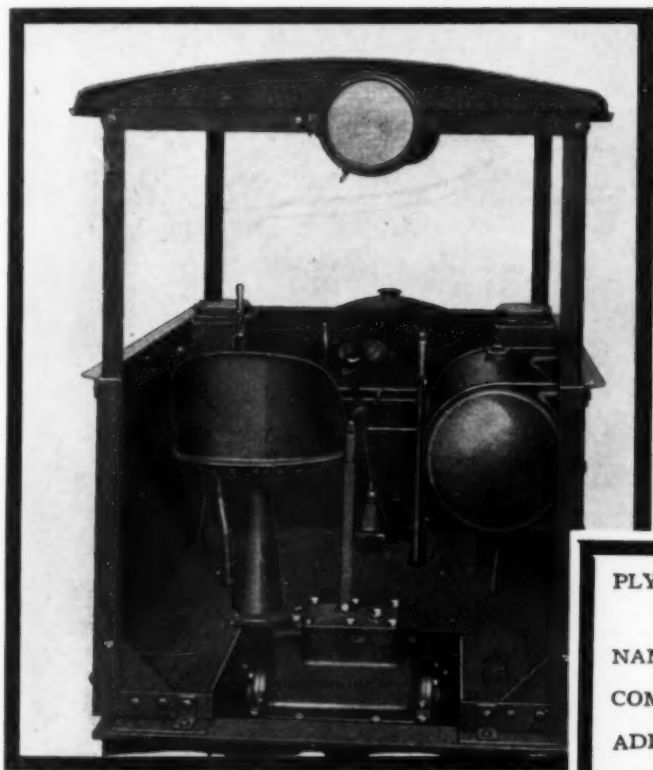
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Plymouth Model TLF 2½, 3, 3½ and 4 Ton Gasoline Locomotives with Ford Engine and 4 Speed Truck Transmission



Rear view showing unobstructed vision and accessibility of control levers

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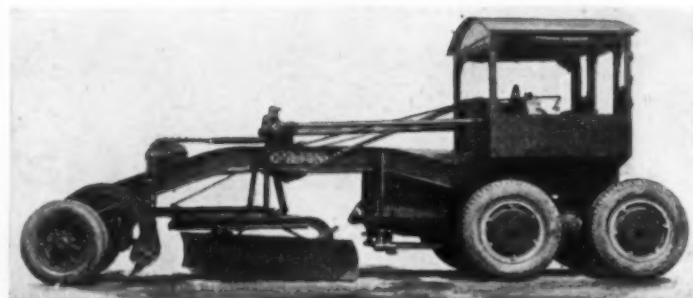
Gasoline and Diesel Locomotives

Three Recent Developments by GALION

DOUBLE DRIVE MOTOR GRADERS

Galion Motor Patrol Graders are now equipped with center drive, which is geared to each set of wheels. This balanced drive construction permits full oscillation and perfect traction at all times. Tractor is pivotally mounted to insure complete flexibility and freedom when passing over uneven ground.

This type of Motor Grader is rapidly winning approval wherever roads are being built.



BANK CUTTING TYPE LEANING WHEEL GRADERS

As shown by the illustration at the right, the extreme adjustment of the Galion Bank Cutting Leaning Wheel Grader permits reaching an angle of approximately 30 degrees off the perpendicular, with wheels on the level, thus giving a wide range of blade adjustment for cutting down banks.

The blade can be extended well outside the line of wheels so that shoulders can be finished without getting grader off the pavement. These adjustments are quickly and easily made.



STONE SPREADERS FOR ROAD WIDENING

The new type of Galion Stone Spreader (patent pending) was especially designed for widening roads. Spreader is attached to rear end of truck and is carried on runners. It spreads stone neatly and uniformly—exactly where you want it—without truck leaving road.

Bottom of spreader is inclined toward the widening trench—opening is adjusted to the width of trench to be filled with stone (see illustration at right).

Complete details on any or all of these Galion developments will be sent on request.



The Galion Iron Works & Mfg. Co.
GALION . . . OHIO



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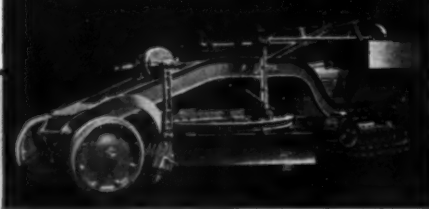
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MAINE, Portland—Eastern Tractor Co.
MASSACHUSETTS, Cambridge—Eastern Tractor Co.
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PENNSYLVANIA PLACES GREATEST CONTRACT

Cletrac-Powered
Galion Motor Patrol



for HIGHWAY EQUIPMENT!

WHAT is probably the largest single order for tractors ever placed by any state, has just been awarded by the Pennsylvania State Highway Department to Cletrac. The order includes a huge fleet of fifty-five "80-60" Cletracs and seventy Cletrac-powered motor patrols to handle the twenty thousand mile highway program recently launched by the State.

Such distinct recognition of Cletrac by a great commonwealth, confirms

unequivocally the sound value and above-average service these great crawler tractors have always given to road builders, contractors and public departments.

Cletrac Crawlers are built in a complete line of five sizes from the small, low-cost "15" to the large "80-60". Ask your Cletrac distributor for a demonstration or write for full information.

THE CLEVELAND TRACTOR COMPANY
19300 Euclid Ave. Cleveland, Ohio

Contract for
**CRAWLER
TRACTORS**

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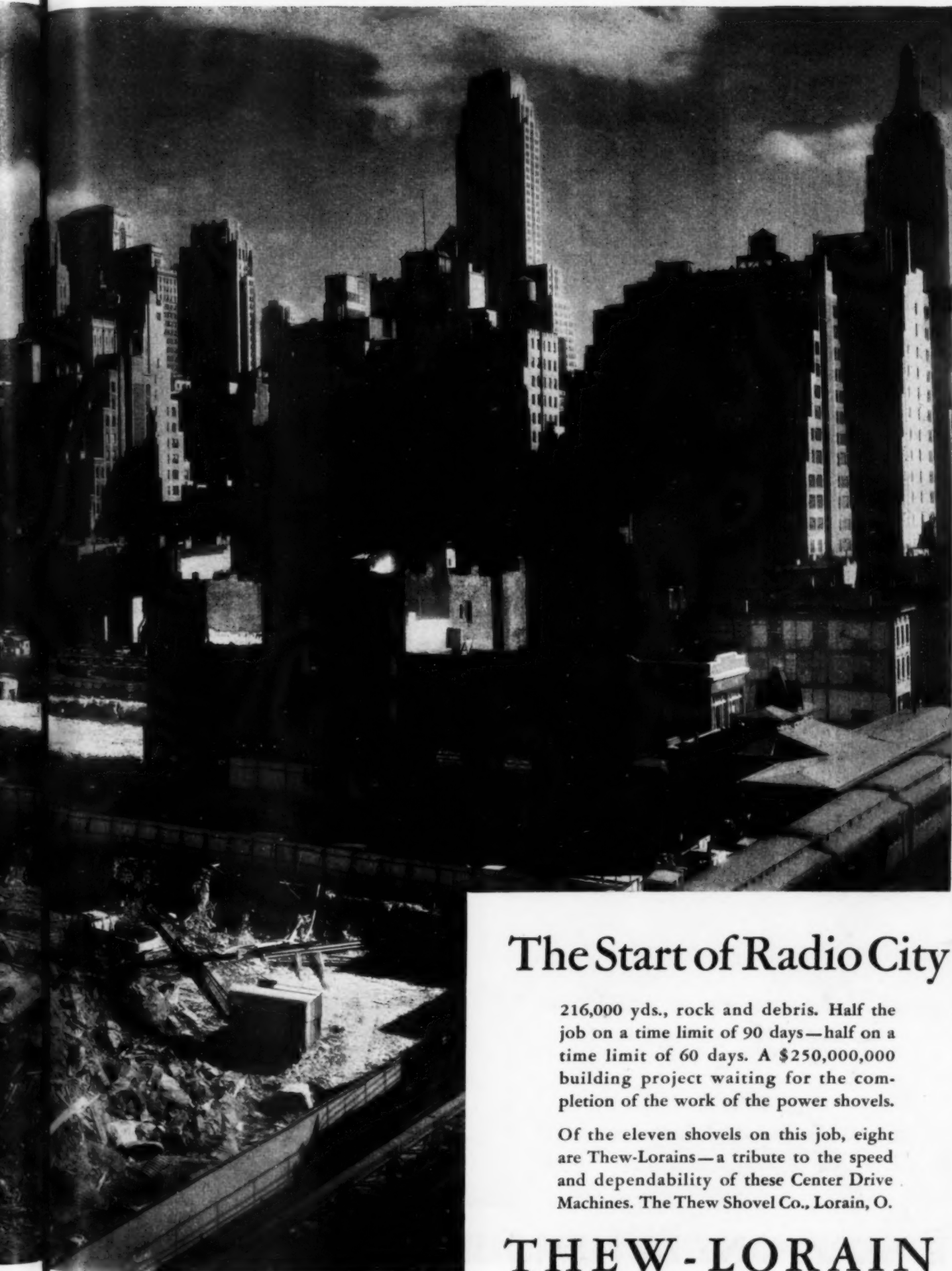
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EXCLUSIVELY!**

Cletrac "80-60"
EQUIPPED WITH HEAD-LIGHTS,
SPOT-LIGHT MUFFLER AND CAB





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The Start of Radio City

216,000 yds., rock and debris. Half the job on a time limit of 90 days—half on a time limit of 60 days. A \$250,000,000 building project waiting for the completion of the work of the power shovels.

Of the eleven shovels on this job, eight are Thew-Lorains—a tribute to the speed and dependability of these Center Drive Machines. The Thew Shovel Co., Lorain, O.

THEW-LORAIN

Through muck



Above—Site of highway in New Jersey where fill settlement problems were encountered

DYNAMITE'S **job is displacing soft** **way Fills to make**

DYNAMITE has found a new job. Today, on thousands of miles of highways, it is helping to simplify one of the most difficult tasks highway construction engineers have to encounter—building roads across swamps and marshes.

Unless the full degree of settlement is attained through the underlying strata of peat or muck, road surfaces soon become uneven, attended by displacement of pavement. This results in exorbitant maintenance costs and makes the road unsafe for travel.

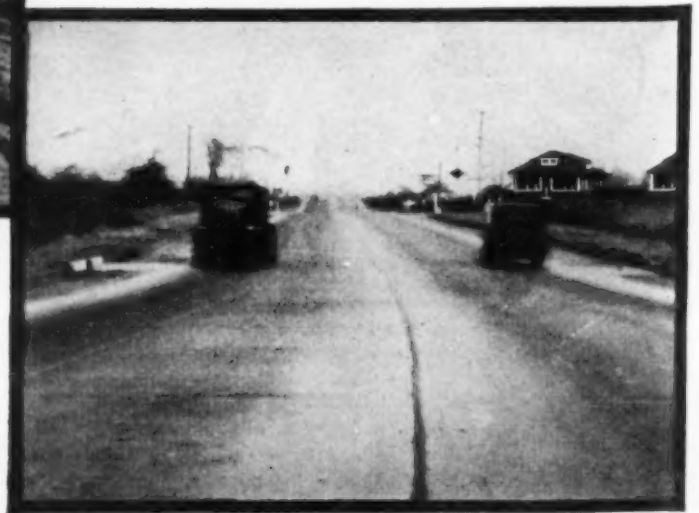
Blasting the unstable underlying material with explosives proves successful in accelerating the settlement of the fill so as to secure permanent roadways. Dynamite dislodges the mud, peat or other material efficiently and quickly. The methods of using dynamite are variable and can be applied in almost any locality. Here are three methods that have been successfully used:

- 1.** The first method is to blast with du Pont Ditching Dynamite as large a ditch as possible along the center line of the projected highway. Such a ditch may be thirty feet wide and eight feet deep. The



Above—Section of highway after dynamiting settled the fill

Right—Same as section above but with pavement completed and subjected to heavy traffic for a period of one year with no appreciable settlement



E. I. DU PONT DE NEMOURS & COMPANY, INC.

to hard bottom

new and successful material below High- permanent roads...

fill is then put in the ditch and piled up in sufficient quantity as to cause a considerable natural settlement, due to its weight, through the remaining unstable material. Blasting a ditch has two functions, first to throw out as much material as possible and second to liquefy or stir up the remaining material so that it can be readily pushed aside by the weight of the fill.

2. The second method is to place the required fill on the top of the marsh and load the dynamite in the mud or muck beneath the fill. Because of the water content of the underlying material, du Pont 60% Gelatin is recommended for this work. The force of the explosion pushes the muck aside and the fill settles in place. Here again the dynamite has two functions, first to create a cavity for the fill to drop into, and second to semi-liquefy the remaining muck.

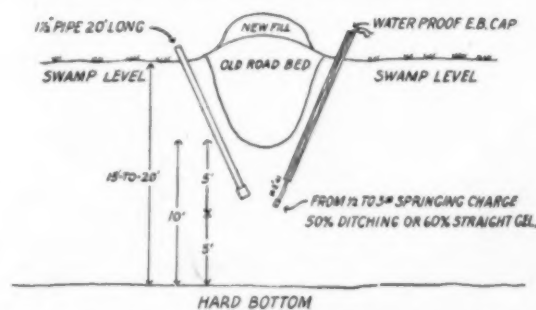
3. The third method is to use du Pont Ditching Dynamite to shoot ditches on either side of the new fill after it has been put in place, in order to relieve the pressure so that the weight of the fill can more easily push out the underlying mud. When the muck is deep, the ditches are not sufficient and extra loads of du Pont Ditching Dynamite are placed in the ditch line at a depth below the bottom of the fill, so that the resulting explosion will force the remaining material out on either side of the fill. This method particularly applies when the fill material is clay and, therefore, will not flow readily.

These three methods may be combined or suitably varied to meet any local condition or problem.

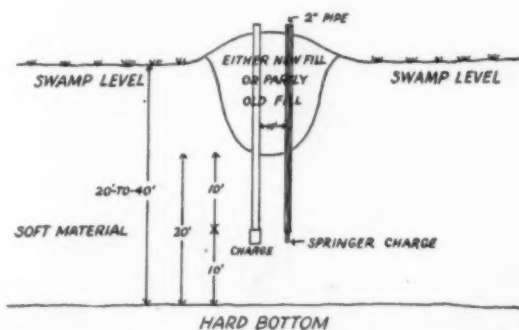
Our explosives engineers are observing and reporting on fill settlement projects in many sections of the country. Their findings are available to engineers, contractors and officials engaged in constructing and maintaining highways. Your inquiries and problems are invited in the interest of better highways, lower maintenance costs and public satisfaction.



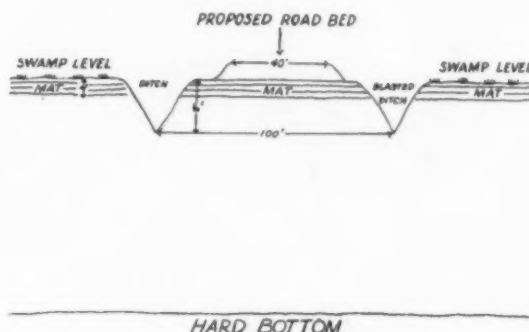
Some methods of loading for Fill Settlement blasts in the Lake States Area



1. Simplest in swamp not over twenty feet deep where conditions will furnish a twenty-foot length of pipe to be forced or driven by hand. Requires no other equipment than hammers, pipe-cutter and other small hand tools.



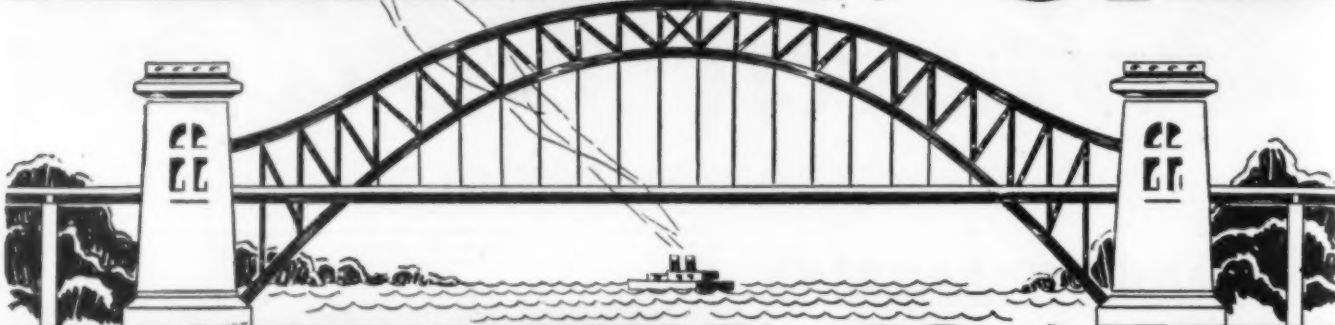
2. The method used in swamps deeper than twenty feet. Requires power-driving equipment.



3. For new work, the idea being to cut the mat and relieve side pressure to give fill better chance to settle, and settle straight. Next step is to blast underneath fill after fill has ceased to settle.

Explosives Department • Wilmington, Del.

BRIDGE



FLOORS

The concentrated loads of present-day vehicular traffic present a difficult problem to bridge engineers. It is a simple matter to construct adequate roadways but the weight of such construction is a serious factor; the more weight a bridge must carry, the more material is required to build it.

T-TRI-LOK has efficiently and economically solved the bridge floor problem. **T-TRI-LOK** is a new form of slab construction involving structural tees in combination with lighter flat bars mechanically interlocked with the tees. Installation is simple. **T-TRI-LOK** is manufactured and shipped in panels which are readily anchored to stringers, and with T members in contact, no form work is required to retain concrete fill. **T-TRI-LOK** forms an armored concrete, non-skid wearing surface of long life and high efficiency.

Send for booklet, "**T-TRI-LOK** Bridge Floor Construction." Carnegie engineers are also at your service.

CARNEGIE STEEL COMPANY

Subsidiary of United States Steel Corporation

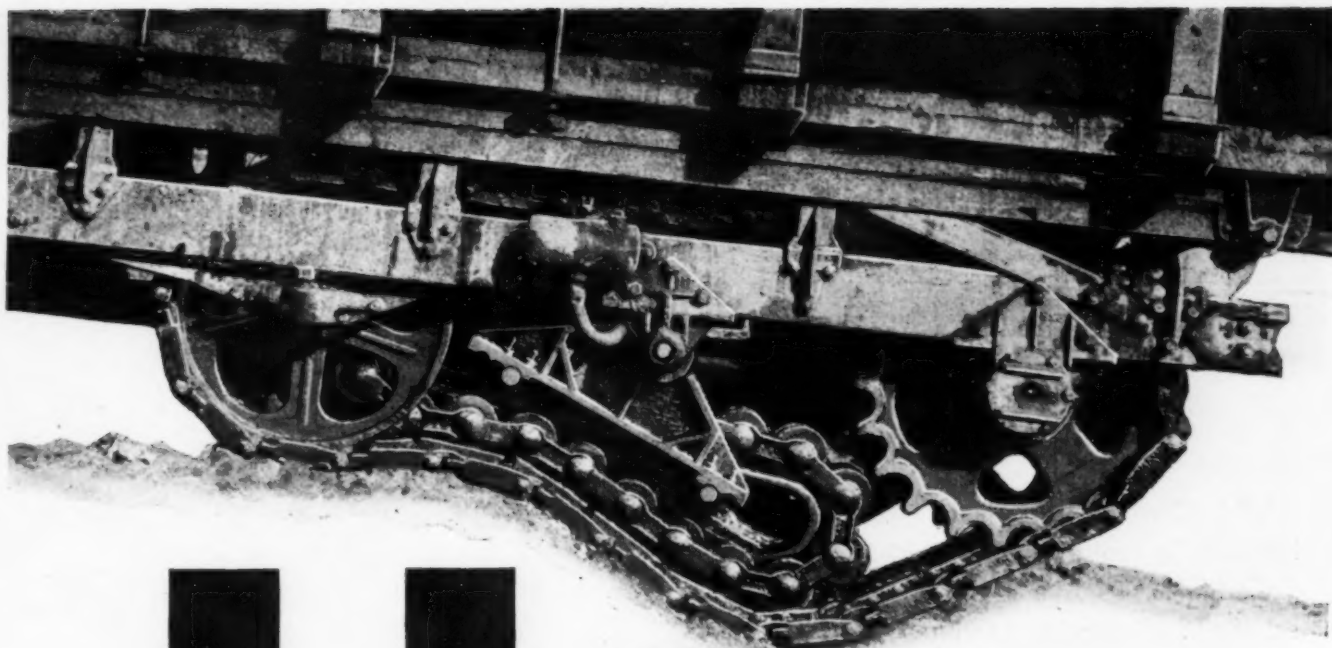
PITTSBURGH



PENNSYLVANIA

153

T-TRI-LOK



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..MAKES THE GRADE!

Carrying a pay load even under adverse ground conditions, LINN marches on where an ordinary truck or tractor lies down.



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Nielsen Certified Surveys on LINN performance in all classes of work will be sent upon request. These surveys give unbiased facts and figures which will enable you to estimate costs to the fractions.



Whatever your hauling or construction job, LINN will make the toughest grade easy... and at a low cost.

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With Carbic Flood Lights you can make up lost time by profitable night work.

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THAT'S THE FINAL TEST OF TRUCK VALUE



After all, the final test of a truck's value is its earning ability. Dodge Trucks not only earn—they earn more, for several very definite reasons.

» » Typical of Dodge value is the Standard 1½-ton chassis. Its price—only \$595 f. o. b. Detroit—calls for but a small investment. Then, because of this truck's many exceptional features, you get greater dependability, ample power, ease of control, speed, safety, economy and long life—all an assurance of maximum earning ability.

» » Inspect and test this 1½-ton truck or any of the many other Standard or Heavy-Duty types in the Dodge line. You will find that the experience gained in building over 400,000 quality Dodge

Trucks assures you a truck that is precision-built and perfectly balanced part-to-part—a truck that will work and earn for you every mile of its long life.

PAYLOAD CAPACITIES IN THE HEAVY-DUTY LINE RANGE FROM 3,600 TO 11,175 POUNDS—AND UP, FOR TRACTOR AND TRAILER SERVICE. PRICES ARE EXCEPTIONALLY LOW. » » THE STANDARD LINE RANGES IN PAYLOAD CAPACITY FROM 1,200 TO 4,300 POUNDS AND INCLUDES **\$595** THE 1½-TON CHASSIS AT F. O. B. DETROIT

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Send your Operating Record Book. I understand there is no obligation.

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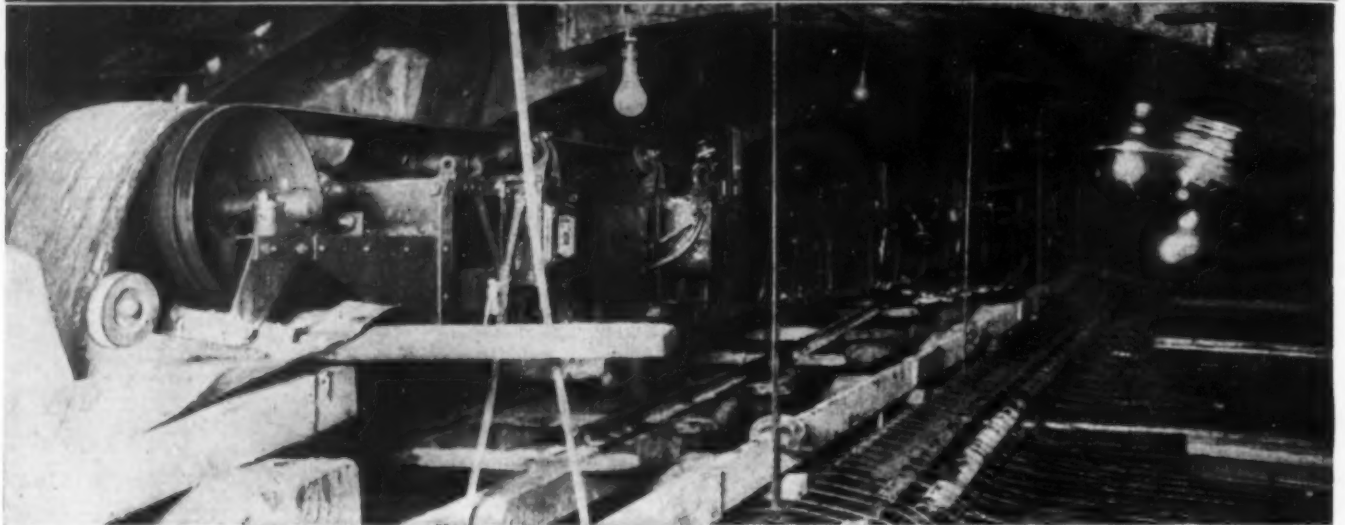
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Beneath a River and an International Boundary



■ A few years ago contractors never thought of belts for handling and placing concrete. Today, B-G Belts are the first thing to think of, no matter what or where the concrete handling job may be.

Here are two B-G Belts placing concrete far below ground, in the Windsor, Canada to Detroit, U. S. A. International Vehicular Tunnel.

Pouring ceiling and side walls in this tube is obviously a difficult problem. It is solved in the top picture. A B-G Belt, mounted as a

shuttle conveyor, carried the concrete along the top of the tunnel. Sweeps at eight-foot intervals sweep the concrete off the moving belt into the roof and side wall forms.

All wall and ceiling concrete, with the exception of a small section at the top, was poured by this conveyor.

The lower picture shows the 48-foot Portable B-G Belt which fed the shuttle conveyor. This same conveyor was used for pouring sidewalks.

Working in tight quarters, like these, shows

how versatile B-G Belts are. Often you will find B-G Belts going where other equipment cannot go. Even more often you will find them replacing towers, chutes, elevators and buggies on jobs where such items have always reigned supreme.

The reasons for this swing to B-G Belts are the simple ones of dollars and cents — days, hours and minutes — and quality of the concrete.

See for yourself. Send the coupon for a copy of Barber-Greene's new book "Concrete Handling".



This application of B-G Belts is one of the many illustrated in Barber-Greene's new book "Concrete Handling", which shows how B-G Belts are cutting concreting costs on widely varying and big and little jobs.

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BEARINGS

Drum shaft and countershaft: double row, self-aligning, shaper roller bearings—two to each drum.

Drum: Large Hyatt Roller Bearings.

Thrust Bearing: Timken Tapered Roller Bearing.

BRAKES

Brakes on opposite end of drum frictions; eliminating heat. 35" diameter, 4" width with 98° contact, providing sure braking on maximum loads and speeds.

FRICTIONS

Blocks of asbestos, graphite molded, give 680 square inches of friction area per drum. This great area plus proper block angle plus Timken Roller Thrust Bearing give new, easy control of loads.

DRIVE

Power is transmitted by a quadruple, roller bearing chain running in a sheet steel case.

FRAME

Welded Unit, Steel Frame.

Base: Heavy I-beam sections with large diameter, patented tubular spreaders.

Side Frames: T-sections with welded-in channel supports. Side frames are welded integrally with the base. This construction defeats side-frame breakage, weaving and misalignment.

POWER

Overhead valve, gasoline engines or AC or DC Electric motors.

There are 108 different hoists in the Novo Line: a size and type for every job. This New 100 h. p. Hoist is typical of what you can expect in our entire hoisting line. The line covers hoists for all types of building and construction jobs, big or small, platform elevators, steel construction, concrete bucket work, etc.

Dragline and Slackline hoists for handling drag-scraper buckets on excavating, grading, moving and storing materials, sand and gravel pit work.

Pile-Driving Hoists for handling pile driving, derrick and clam shell bucket or steel erection on bridge, dam and similar jobs.

So no matter what your requirements:

Come to Hoist Headquarters for performance, for value, for information.

First Real Hoist Advancement in Years

New Novo Roller Bearing, 100 H. P. Hoist

These pictures tell part of its story. The girder pictured weighs 60,240 pounds. It is handled by an 80-foot mast with a 90-foot boom on a 50-foot radius.

New Design and Construction give this New Novo:

- (1) New smooth, surplus power that rivals steam for action
- (2) New surplus braking area for positive control of heavy loads
- (3) New surplus friction area, plus a close feather-touch control, handles heavy loads with only a slight effort on the lever
- (4) New anti-friction design throughout defies wear and conserves power and fuel
- (5) New base and frame design that prevents side-frame breakage, weaving and misalignment

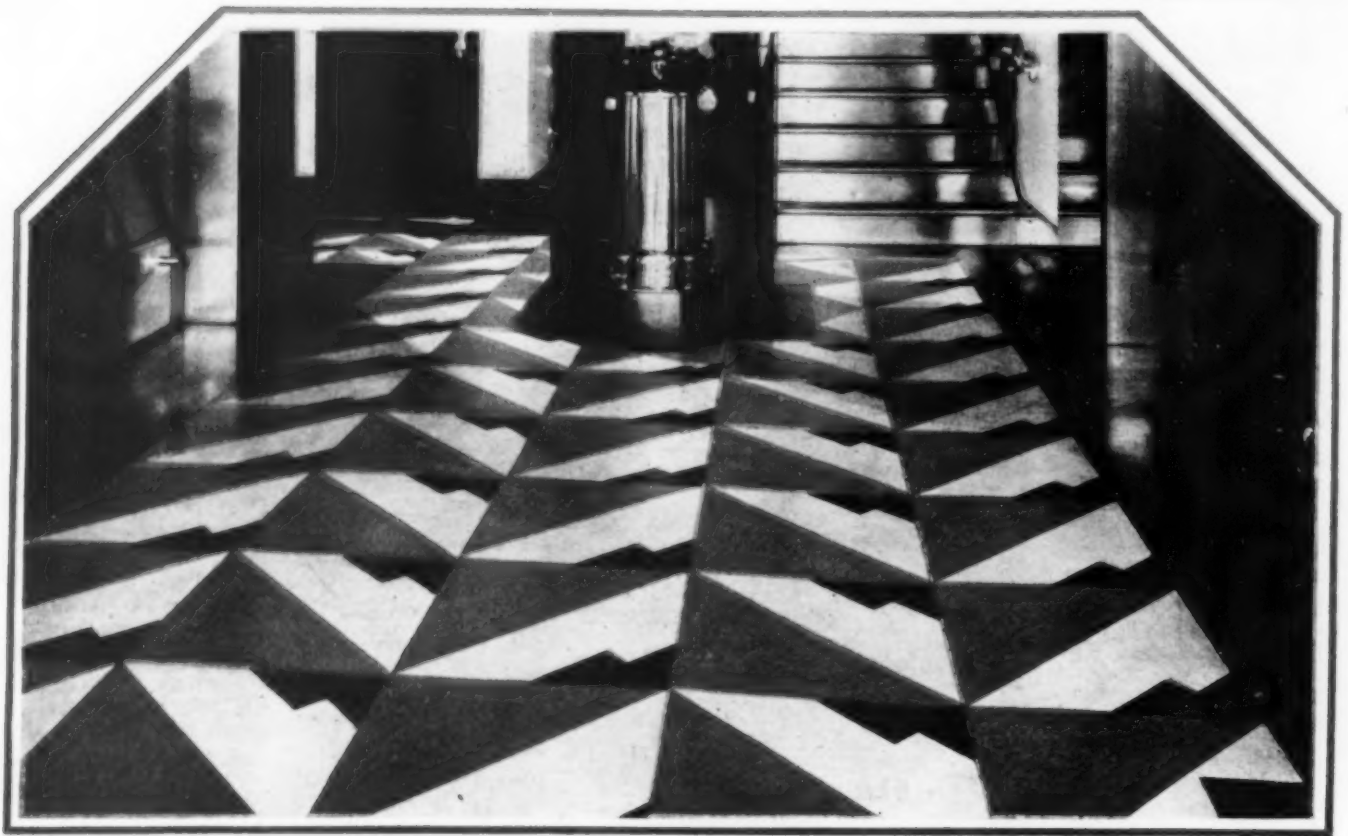
Check the facts to the left—which make this New Roller Bearing Novo Hoist the fastest, most efficient you can put on a job.

NOVO ENGINE COMPANY

Clarence E. Bement, Vice President and General Manager
214 Porter Street, Lansing, Mich.

Job: City National Bank Building,
Lansing, Michigan.
Gen. Cont.: Reniger Construction
Co., Lansing.
Steel Cont.: Jarvis Engineering Co.
Lansing.

NOVO
Headquarters For Hoists



A true-color reproduction of the terrazzo floor in the lobby of the Cinderella Bldg., St. Paul. Artcraft Mosaic Co., St. Paul, used Atlas White portland cement for the terrazzo.

Terrazzo made with Atlas White insures colorful, durable floors

IN designing the colorful terrazzo floors now so much in vogue, marble chips of many shades and hues are used. To bring out and preserve the true color value of these chips, a pure white or lightly-tinted background is essential. Atlas White, a pure white portland cement, furnishes an ideal background for white, black or colored marble chips. It is used from coast to coast for fine terrazzo.

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me further information on
Atlas White terrazzo.
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Construction Methods

A MCGRAW-HILL PUBLICATION—ESTABLISHED 1919

ROBERT K. TOMLIN, Editor

VOLUME 13

NEW YORK, SEPTEMBER, 1931

NUMBER 9



Double-Chambered STEAM VACUUM PUMP *Handles Dredged Spoil*

AN 8-IN. Pulsometer steam pump is disposing of 40,000 yd. of mud dredged with clamshell bucket to deepen the channels of a lake at Millerton, N. Y. Courtney Campbell of New York City is the contractor. A $\frac{3}{4}$ -yd. bucket, operated by a gasoline crane mounted on a float made of gasoline barrels, digs the mud and loads it into 60-yd. scows. The scows are taken by a motor launch to the shore of the lake, where the Pulsometer, supported on a similar float, pumps the material from the scows to the discharge pool, which is dammed by earth dikes.

A small gasoline centrifugal pump supplies water to two pressure jets used to break up large clods in the scow. Because the Pulsometer unloads faster than scows can be loaded and moved alongside, it actually operates only about five hours during each ten-hour day,



CONTINUOUS STREAM (*above, left*) containing up to 35 per cent solids flows from 7 $\frac{1}{2}$ -in. discharge pipe. STEAM VACUUM PUMP (*above*), resting on float, unloads 60-yd. scow in 20 min. Pressure jets from small centrifugal pump adds water to mud. Sticks and stones do not clog pump or cause it to lose prime.



COAL CONSUMPTION is $\frac{1}{4}$ -ton per day to pump 720 yd. Pump operates half time during 10-hour day. Boiler is almost double size required.

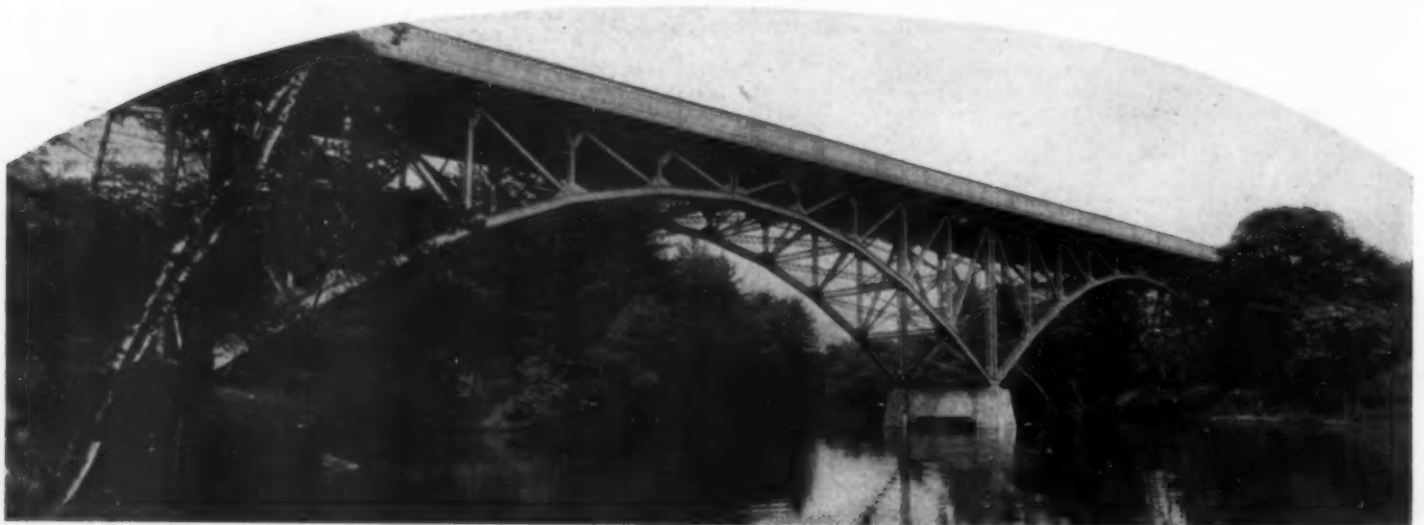
pumping out eleven or twelve 60-yd. loads at a total labor-and-fuel cost of approximately 45c. per yard. The pump will finish the job in two months. Although the boiler used, 125-hp., is almost twice the size, 70-hp., required for the pump, the total expense of equipment and labor of installation (including first cost of pump and spare parts, making floats, trucking, boiler rental, and work on dikes) amounts to less than \$3,000. Mr. Campbell claims that the Pulsometer is cheaper and faster than any other means he has used to handle or pump dredged material.

This Month's "News Reel"

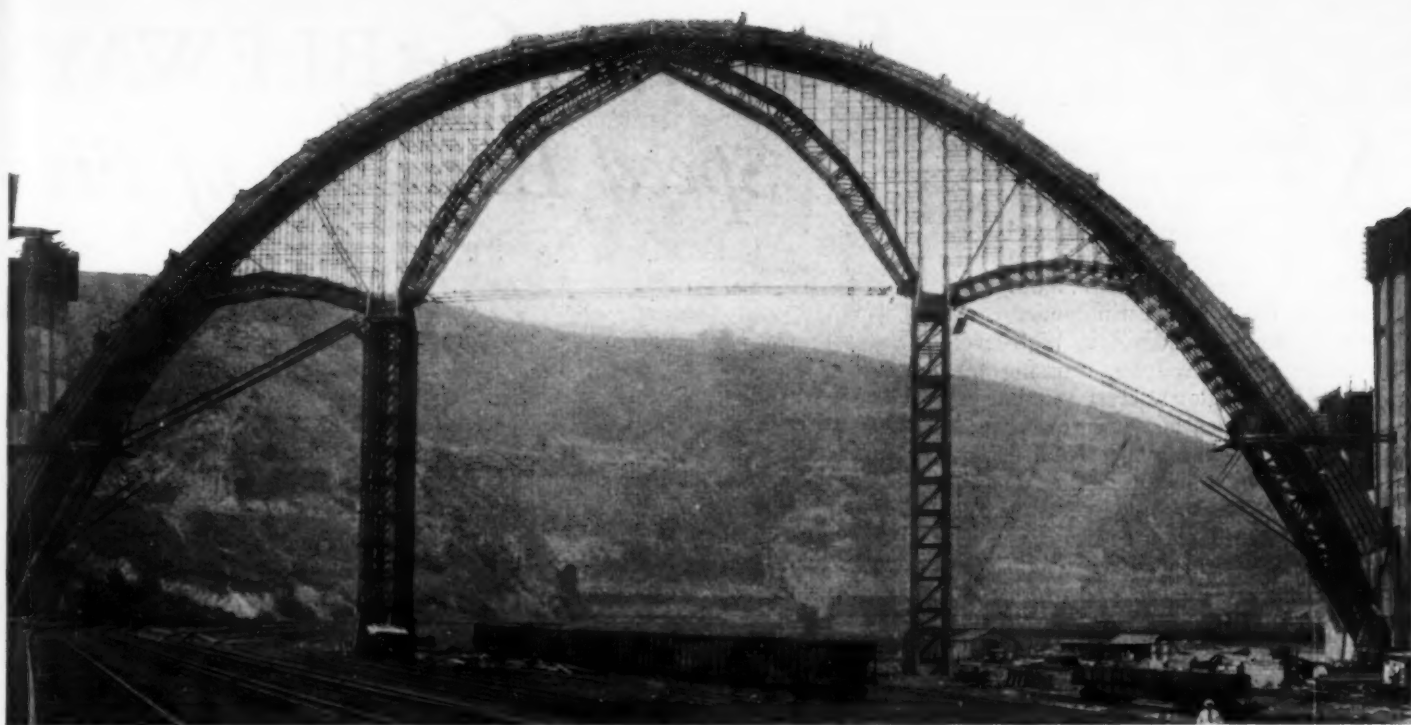


TRACK-LAYING RIG extends line of Great Northern Railroad into California for first time, connecting San Francisco directly with northern tier of states between the Great Lakes and the Pacific Coast. Machine, placing 2 miles of track daily, has mechanical carriers for ties and rails. Spikes are driven with pneumatic hammers.

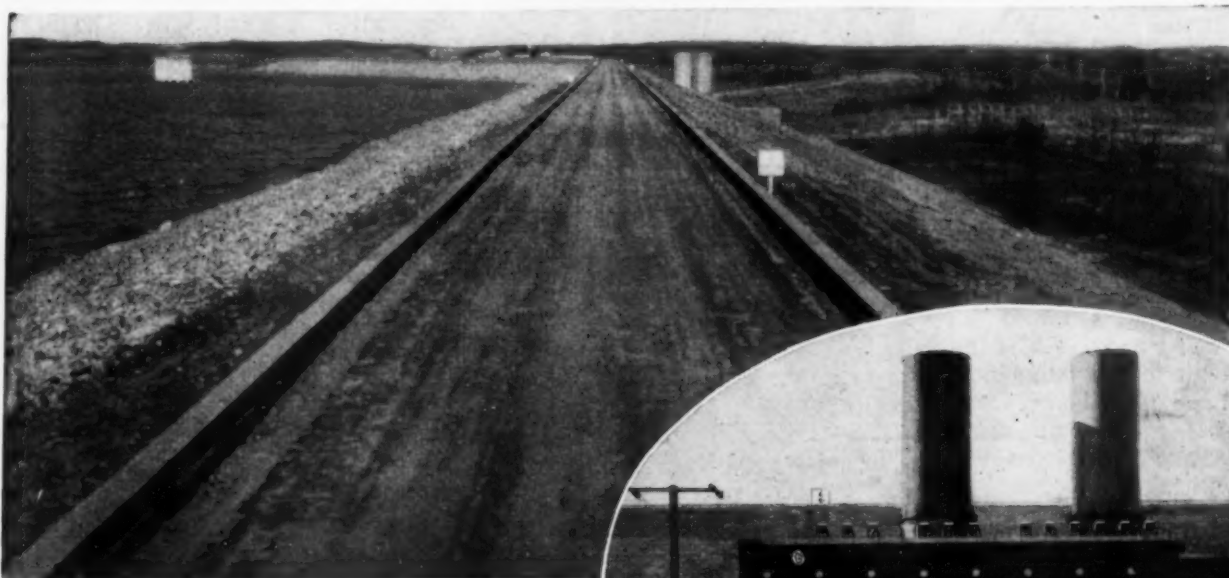
CONTRACTORS' LICENSE BILL (right) signed by Governor Rolph of California. To the left of the Governor is W. J. Wilkinson, president, California Chapter, Associated General Contractors of America; at the right are Carlos W. Huntington, registrar of contractors and Adolph Teichert, Jr., president, Northern California Chapter of the A.G.C.



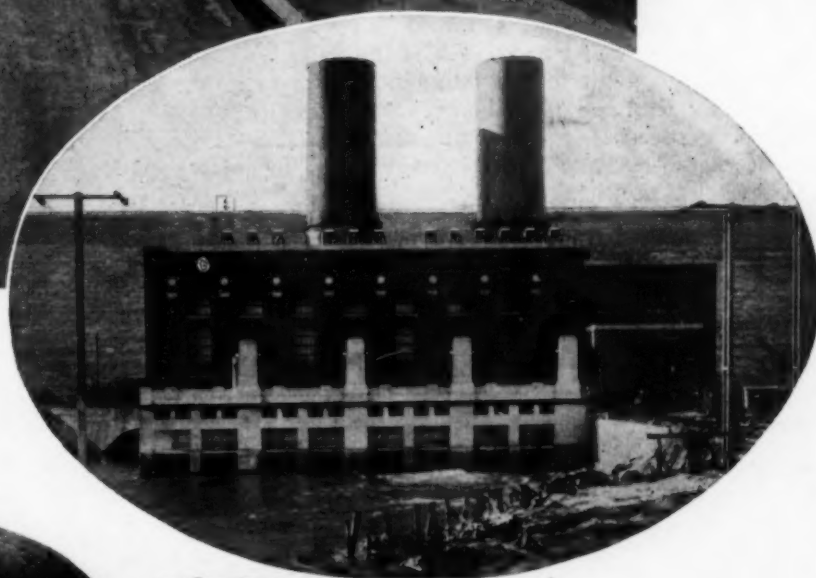
MOST BEAUTIFUL SMALL BRIDGE erected during 1930. Delton steel arch highway bridge in Sauk County, Wisconsin, costing \$54,000, receives award by American Institute of Steel Construction. Structure was designed by Wisconsin Highway Commission and fabricated by Lakeside Bridge & Steel Co. Arch spans are each 218 ft. long.



STEEL CENTERING in place for concreting the main arch, with a span of 460 ft. between pier centers, of the George Westinghouse bridge at East Pittsburgh, Pa., described in detail elsewhere in this issue of *Construction Methods*. Three-track tower cableway with span of 1,650 ft. handles concrete forms and centering for five-arch bridge 1,500 ft. long.



SALUDA DAM AND POWER HOUSE (above and at right) are completed and in service near Columbus, S. C. Hydro-electric project costing \$22,000,000, built by W. S. Barstow & Co., Inc., with Arundel Corp. as sub-contractor, includes dam containing 11,000,000 cu.yd. of earth fill, largest in world built for power development purposes. Crest length of dam is 7,900 ft. and maximum height 208 ft. above rock foundation.



©Wide World



NEW RAILWAY TERMINAL (left) is completed at Milan, Italy. Central station has series of five arched-roof trainsheds providing modern transportation gateway to industrial Italy.

TOWER CABLEWAYS

Speed Building of Five- With 460-Ft.

A THREE-TRACK tower-cableway system, steel arch centers, and a central mixing plant are the principal items of equipment being used by the Booth & Flinn Co., of Pittsburgh, contractor, to build the five-arch George Westinghouse concrete highway bridge, a high-level structure 1,500 ft. long, crossing the Turtle Creek valley at East Pittsburgh, Pa. The main span, 460 ft. between pier centers, is the longest reinforced-concrete arch to be constructed in this country. A well-planned schedule for progressive utilization of the centering has enabled the contractor to pour the ten ribs of the five spans in rapid sequence. Concreting of the first rib began Jan. 30, 1931, and the tenth rib was completed Aug. 29, 1931.

The bridge is the outstanding feature of a much-needed Lincoln highway relocation, originally proposed by the Pennsylvania department of highways. The cost of the bridge is being shared equally by the state and Allegheny County. The bureau of bridges of the Allegheny County department of public works designed the structure and is supervising its construction.

Bridge Design—Local conditions determined the choice of a five-span bridge. The design was made as symmetrical as possible about the central arch, with intermediate spans of 295 ft. each and abutment spans 196.33 ft. long at the east end and 277.5 ft. at the west. A fault in the foundation rock at the west end of the bridge compelled the engineers to locate this abutment some distance back from the symmetrical position.

All piers and abutments rest on sand-

stone rock except Pier 1, which is founded on hard shale. Foundations of Piers 2 and 3, supporting the main arch, are 42 ft. long by 50 ft. wide, from bedrock to a point about 15 ft. below the ground surface, where they widen out to 74 ft. The design of the other two piers is similar, with the exception that the dimension longitudinally with the bridge is shortened.

From just above the ground surface

to the top of the upper skewback, the piers are solid except for a central well, 15 ft. wide, transverse to the bridge, and, in the main piers, about 30 ft. long. The outside transverse walls tie together the two solid masses separated by the central well. Above the upper skewback, the piers are cellular, with reinforced-concrete walls forming the sides of the shaft. The walls are vertical on the inside and are battered $\frac{1}{8}$ in. in 12 in. on the outside, reducing to a minimum thickness of 18 in. at the roadway. This batter gives a maximum thickness at top of foundation of about 5 ft. The shaft walls are stiffened by pilasters on the four sides of the pier.

The bridge roadway will be 42 ft. wide, providing for four lanes of traffic between curbs. Two 7-ft. sidewalks are carried on cantilever brackets. The roadway rises on a 4 per cent grade from west to east.

All arches consist of two ribs 14 ft. wide spaced on 32-ft. centers. For the central arch, with a high rise of 158 ft. and a span of 411.52 ft., springing line to springing line, the ribs were designed 5 ft. deep at the crown and 10 ft. at the spring line.

Reinforcing in each main-span rib consists of 34 $1\frac{1}{4}$ -in. square bars, equally divided between top and bot-



ARCH RIB CONSTRUCTION starts at Span 1. Workmen are preparing to pour crown segments of south rib, Span 1. Cableway is erecting hinged closing section of steel centering for north rib, Span 2. Steel towers (above) to carry main-span centering.

AND STEEL CENTERS

Arch Concrete Bridge

Central Span

tom. On all other spans, each rib is reinforced with 28 1½-in. square bars, likewise equally divided between top and bottom. Light structural-steel cross-frames about 15 ft. apart supported the bars on the concrete form, the bars being fastened to the frames with hook bolts.

The columns of each structural bent supporting the deck consist of pairs of shafts, one pair on each arch rib. The distance center to center of columns was selected to balance as nearly as possible the dead loads from the floor beams and projecting sidewalk brackets. Inside shafts of the bent are 20 ft., c. to c., and outside shafts are 34 ft., c. to c. All shafts have a width transverse to the bridge of 2 ft., except the end columns of the main span, which are 2½ ft. wide. The dimension longitudinally with the bridge varies from 4½ ft. for the longest columns to 2½ ft. for the shortest.

The two shafts of each column are connected at the top by a heavy diaphragm under the floor beam, and the longer columns are tied together by intermediate struts spaced a maximum clear distance of 30 ft. apart.

Pier Construction—All piers were constructed simultaneously. Rock foundation under the abutments was uncovered a short distance below ground surface. Pier 1 was carried 50 ft. to red shale and Pier 4, 35 ft. to sandstone, by open excavation. Reinforced concrete caissons were sunk 90 ft. at Pier 2 and 55 ft. at Pier 3. It had been expected that compressed air would be needed in the caissons; but both piers were unwatered by pumps without difficulty, and foundations were poured in the dry. Total excavation for the foundations amounted to 24,000 yd.

Cranes and stiffleg derricks, excavated the piers with clamshells and concreted them by bucket. At Piers 2 and 3, steel stifflegs with 90-ft. booms, powered by steam hoists, were used to reach all parts of the caissons from one set-up of the mixer. A P&H gasoline crane with an 80-ft. boom and a Thew gasoline machine with a 60-ft. boom operated at the other two piers.

A Ransome 27-E paver, batched by trucks, mixed the concrete at each pier, being moved from one pier to another in accordance with the construction schedule. The cranes and derricks carried the concreting of the piers to an elevation about 30 ft. above the ground, pouring about 32,000 yd. in all.

As the east abutment offered the most desirable location for the tail tower of the cableway system, it was



PREPARING FOR MAIN-ARCH CONSTRUCTION. Structural steel towers are erected to support centering for main-span arch. Columns and deck have been completed on Span 1, in front of tail tower of cableway system, in foreground. **CABLEWAYS (above)** concrete piers above 30-ft. level with 5-yd. bottom-dump buckets.



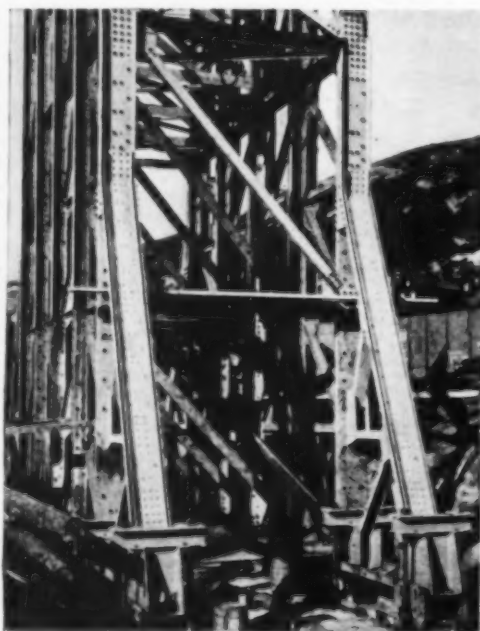
CABLEWAY ERECTS CLOSING SECTION of steel centering for north rib, Arch 4.



MAIN-SPAN CENTERING almost completed for north rib. Timber falsework is erected on steel centers supported by structural towers.

imperative that construction of the abutment be rushed to early completion. Because of the inaccessibility of this abutment (the approach to which required a cut 165 ft. deep) excavation was carried on by hand, and concrete was chuted 400 ft. from the top of the hill, 190 ft. above the bridge deck, where trucks could deliver batched materials to the mixer. The 400-ft. chute line, equipped with two intermediate control hoppers, delivered concrete to a 2-yd. receiving hopper. Hand buggies wheeled the concrete from this hopper to the forms.

Tower Cableways—For a high-level concrete bridge on which steel centers are used, a tower-cableway is the logical means of handling materials. The cableway system for the Westinghouse bridge comprises two tracks over the north ribs, where the steel centers are erected, and one track over the south ribs. Erection of the cableway towers was started as soon as pier construction had advanced a short distance above ground. Each of the two towers is designed for a load of 50 tons on the north side, 25 tons on the south, and 28 tons in the center, the last providing for a track along the center line of the bridge if the contractor



TOWER is bolted to concrete base.

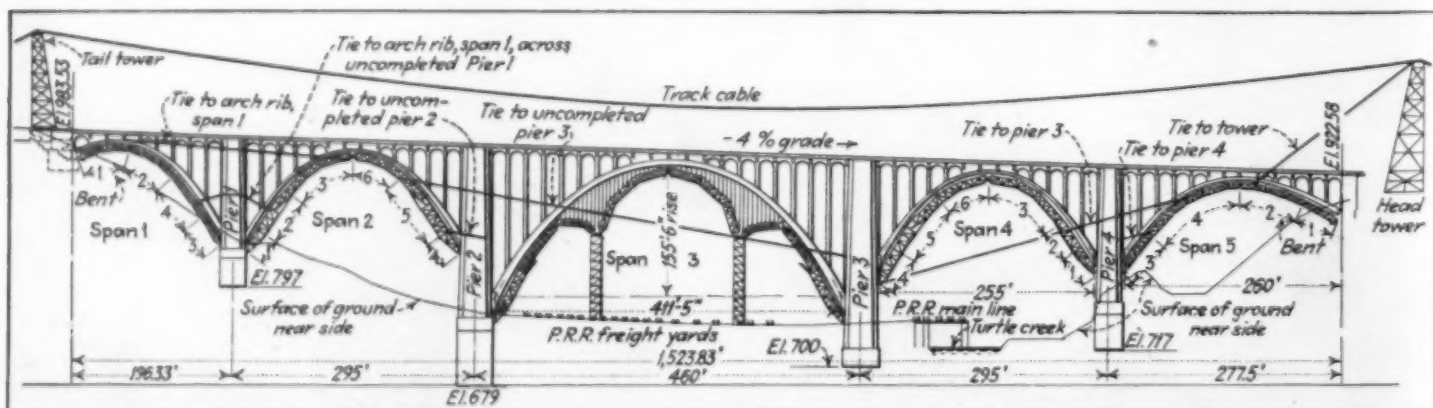
should desire to use one on the work.

The head tower, 150 ft. high, rests on level ground back of the west abutment, with the top of the tower about 126 ft. above the bridge deck. The tail tower, 110 ft. high, rises approximately 113 ft. above the deck at the east abutment.

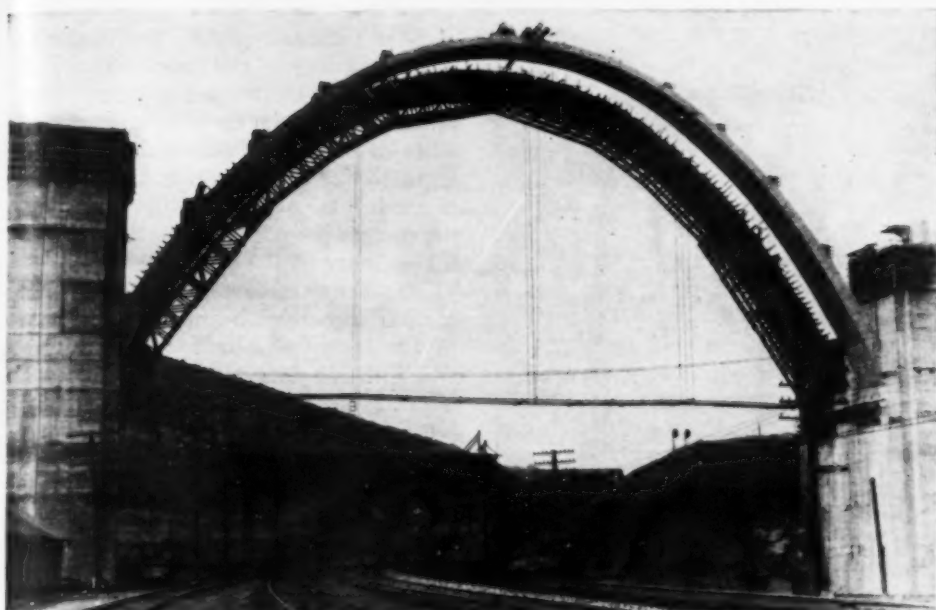
A. J. Eldridge, of Columbus, Ohio, designed the tower-cableways and aided in supervising their erection. Each tramway is equipped with Lidgerwood trolley carriers and is operated by a Lidgerwood steam hoist, with a 12x12-in. load drum and a narrow endless cable drum, both of which give a single line speed of more than 2,500 ft. per minute. The hoisting block of the five-part load line has a speed of over 500 ft. per minute. All cables are Leschen Red Strand wire rope. The two track cables over the north rib are 2½-in. rope, and the south track cables are 2½-in. Lead lines and endless hauling ropes are ¾-in.

The cableway span is 1,650 ft. Natural sag of the cables is about 75 ft.; under a 25-ton load, the sag amounts to some 92 or 93 ft.

In preparation for erecting the track cables, two ¾-in. hemp ropes were pulled across the valley by hand, passing over a street-car trolley wire and four main-line tracks of the Pennsylvania Railroad en route. The two hemp ropes were used to pull across two ¾-in. wire cables, one at a time. These cables served to stretch two track ropes across the cableway span, one over the north rib and the other



NORTH ELEVATION of George Westinghouse bridge. Numbers under centers indicate sequence of erection for steel arch centering on Spans 1, 2, 4 and 5. System of tiebacks for centering on Spans 2 and 5 is shown. Ties for Spans 1 and 4 are similar to those shown.



TRUSSED FLAT ROOF under Span 4 protects main-line tracks of Pennsylvania Railroad from danger of falling objects.

over the south. The north track cable erected the second track rope on the same side of the bridge.

The south cableway was erected on the center line of the south rib; the north cableways were located 3 ft. apart, each of them being $1\frac{1}{2}$ ft. off center line.

Steel Centering—Steel for the Blaw-Knox centering was brought in from the Ohio River boulevard, where it had previously been used on five concrete arch bridges, as described in *Construction Methods*, Feb., 1931, pp. 40-41. The steel was bolted into units under Arch 2, on the only ground available for assembly work.

As all the piers were designed to be stable under unbalanced arch thrust, it would have been possible to erect the ribs in any order. The contractor, however, determined to construct the abutment arches first, to use them as tiebacks for the centering under the intermediate arches. For the same reason, it was desirable to pour the intermediate arches before erecting the centering for the central span.

Sufficient centering was available to support one abutment arch rib and one intermediate arch rib. Because of its proximity to the assembly ground, the contractor decided to erect Arch 1 first. This decision, together with the considerations already mentioned, determined that the sequence of operation should be: Span 1, Span 2, Span 5, Span 4, and, last, Span 3.

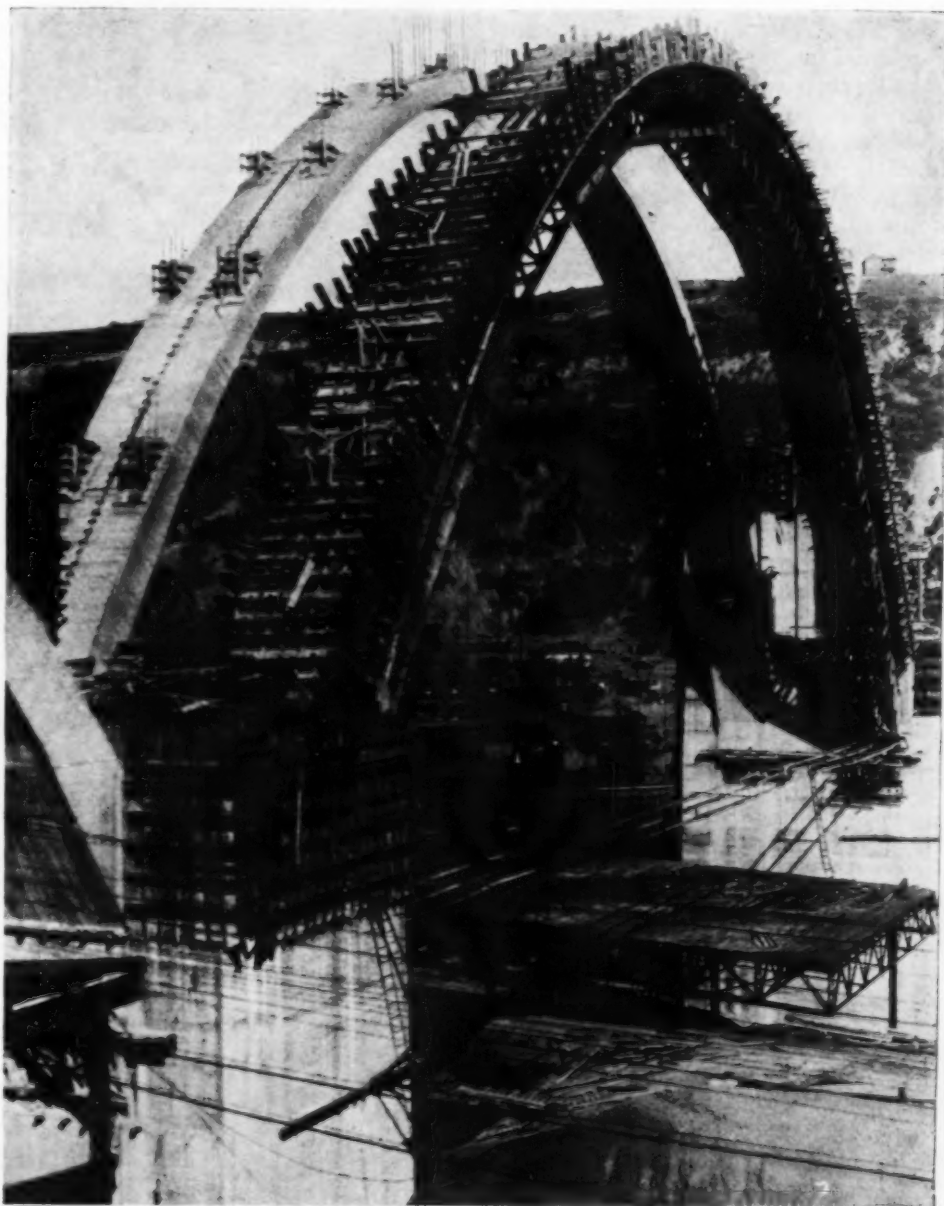
Centering for each arch was erected by the cableways on the north side. After concrete in this rib had cured sufficiently, the centering was moved to the south rib.

Centers for Arches 1 and 5 consisted of six light, parallel trusses, erected in four units designed to give a maxi-

mum single cableway load of 20 tons. In starting erection of Arch 1, the haunch section at the abutment was supported on a temporary timber bent. To reduce the load on the cableway at this point, close to the tail tower, the contractor used a tractor on the ground which helped to pull the haunch section up the slope.

The second unit of Arch 1 centering was erected by the cableways on the haunch section and was tied back to the tail tower. In the same way, the cableways placed the second haunch section and the hinged closing section, which were tied back to Piers 1 and 2, respectively. The accompanying sketch indicates the order of erection and the system of tiebacks.

Erection of Arch 5 followed the same plan as Arch 1, except that five centering units were needed to provide for the longer span. On both Arch 1 and Arch 5 the full six trusses were erected as a unit in the haunch sections; but only three trusses were



FORMWORK erected on steel centering, south rib of Span 4.

placed in the first operation of erecting the other units, the remaining steel being filled in later.

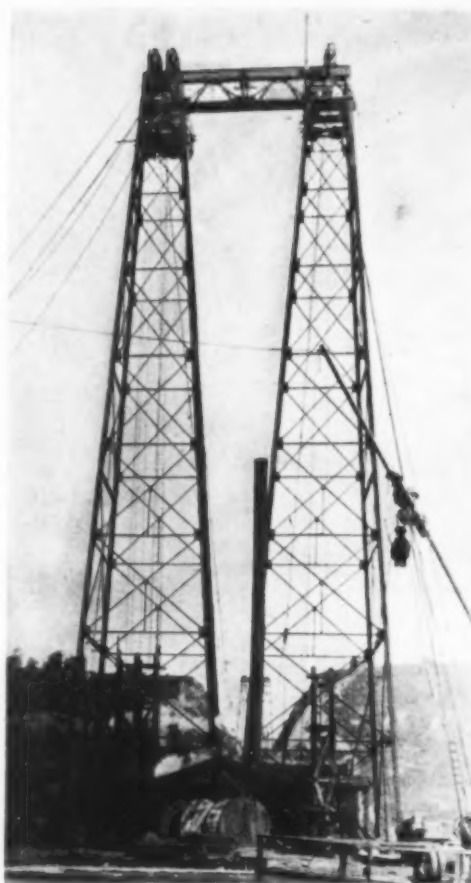
Much the same process of partial erection and filling in later was followed on Arches 2 and 4. A distinct set of centering, consisting of three heavier steel trusses, supported the forms on these arches. This centering was erected and tied back in six units, as indicated by the sketch. The cableways placed the haunch sections complete but erected only two trusses of the other units at first, supplying the third truss later. Weight of the steel units varied from 15 to 35 tons.

Both sets of centering, plus additional steel truss units, were needed for the central span. Two structural steel towers on concrete bases, 163 ft. apart, c. to c., supported this combination of centering, which totaled 710 tons in weight. Timber falsework built up on the steel centers carried the rib forms. The sketch illustrates the method of utilizing the short-span centers to support the main-arch forms.

Moving Centers—Arch centers were supported at all piers by structural steel brackets resting on recessed bases formed in the masonry. A reinforced steel channel resting on the two brackets at a pier served as the track for moving the steel center from the north rib to the south. This channel track was perfectly level.

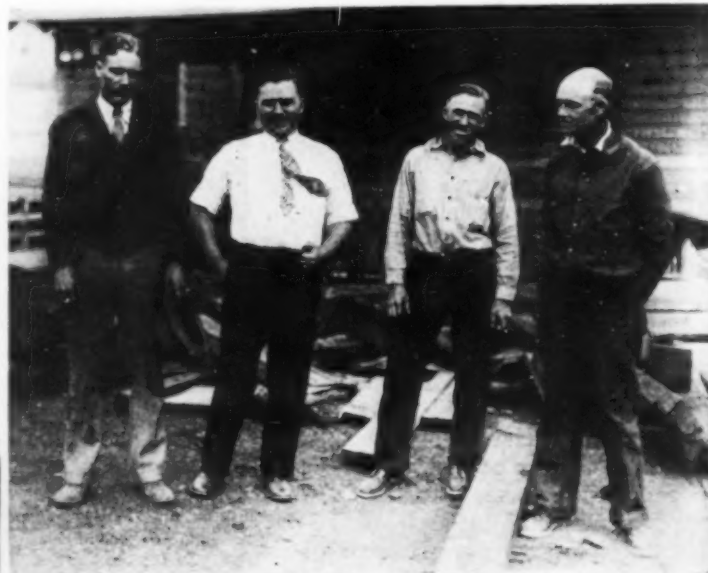
A channel shoe under the end of the centering rested on the track. As illustrated by one of the photographs, the channel forming the shoe was wider than the one serving as a track; the flanges of the shoe were turned down over the track channel. Both track and shoe were greased.

To lower the center for moving, the steel wedges at each haunch were released and, often, the wood wedges were knocked out from under the intrados form to free it from the concrete. A 100-ton Duff ratchet screw

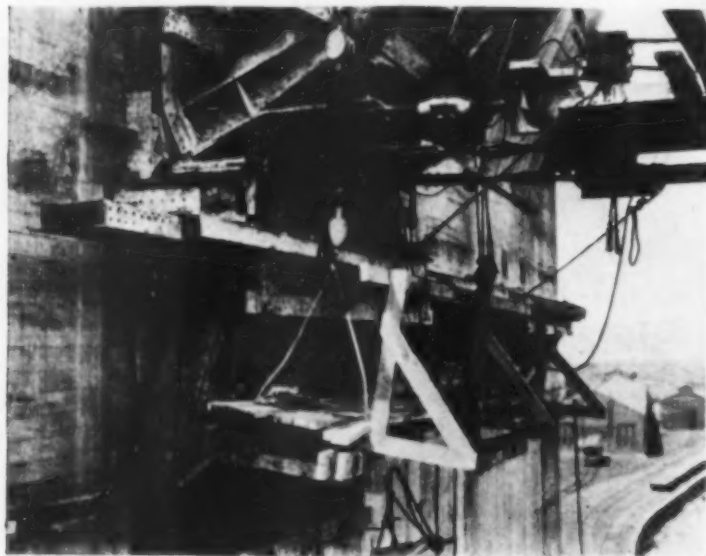


HEAD TOWER of cableway system, with three steam hoist engines at base.

N. H. McLAIN (left) superintendent; S. R. HARPER, assistant engineer, in charge of construction; CHARLES E. WHITCOMB, contractor's engineer; and R. A. ALEXANDER, assistant superintendent.



STEEL CHANNEL (left) on structural brackets serves as track for moving arch centering from north rib to south. Shoe under centering is wider channel with flanges turned down over track.



jack at each end pushed the center to its new position. The jacks, which had a run-out of 12 in., had to be reset 32 times to move the center the total distance of 32 ft. Considerable time was required for the operation. The force necessary to overcome the inertia of the centers proved to be much less than the capacity of the jacks.

To steady the center during moving, a cantilever steel beam was anchored to the crown of the completed north rib, with the cantilever arm extending beyond the south rib. Two sets of block and tackle, anchored to the beam, were attached to the centering, one on the north side and one on the south. Workmen took up on one set and slacked off on the other as the centering moved. Four 100-ton hydraulic jacks raised the center to position under the south rib.

Concrete Forms—All forms on the Westinghouse bridge are of watertight construction, built to satisfy the specifications of George Hockensmith, vice-president and general superintendent of the Booth & Flinn Co. Mr. Hockensmith is a practicing advocate of the theory that disintegration of concrete, in cold climates, is the result of careless formwork.

Forms for piers, arch ribs, and columns were designed for repeated use,

with slight modification, on similar parts of the bridge. Panel forms of 2x6-in. tongue-and-groove lumber were used for the full height of the piers, which were poured in 15-ft. lifts. The panels averaged 15 ft. square; but some were as much as 25 ft. wide. Studs of 2x6-in. lumber were spaced about 15 in., c. to c., and double-2x6-in. wales were about 24 in. on centers.

Especially tight forms were used on the arch ribs. The intrados surface form consisted of three-ply 1-in. ven-

eer board on 4x4-in. lagging, spaced 6 in., c. to c. Rib side forms were made of 2-in. tongue-and-groove lumber. All cracks were sealed with a mixture of sawdust and glue, assuring a leakproof form and a dense concrete surface free from pores. High early-strength concrete was used in the ribs, as on the Ohio River Boulevard bridges, to gain earlier removal of the centering.

Form bolts in ribs and columns are $\frac{3}{8}$ -in. high-tension steel, instead of ordinary $\frac{3}{4}$ -in. steel. Metal sleeves are used on the bolts to permit pulling them entire. To avoid rust streaks on the concrete surface, the sleeves are cut back 2 to 3 in. from the form. The resulting bond with the concrete is not strong enough to prevent pulling the bolts with ordinary rod jacks. Mortar and grout are used to seal the holes.

Forms are made at the job. Both forms and reinforcing steel are assembled in large units before being raised and placed in position by the cableways. The bridge requires a total of 3,500,000 lb. of reinforcing steel.

Concreting—Arch rib forms were bulkheaded into sections, with key blocks 4 ft. long between sections. On the main span, the design provided three keys; but the two closing sections were short enough to act as keys. The

sections of each rib were spaced symmetrically with respect to the arch axis, and the segments were poured two at a time.

Ribs of Spans 2 and 4, for example, were each poured in six sections. The procedure in placing concrete on each of these ribs was to pour the two haunch segments first, the crown blocks second, and the intermediate sections last. Concreting of two segments was carried on in alternate steps to keep a nearly balanced load on the centering. Column stubs about 1½ ft. high were poured with the ribs.

A central mixing plant on the Span 3 side of Pier 3 is producing all the concrete (approximately 37,000 yd.) except that in the piers below the 30-ft. level. The cableways place the concrete from Owen 5-yd. Stange buckets. A Jaeger 2-yd. mixer, powered by a Hercules 60-hp. motor, mixes 11- and 12-bag batches of 1:2:4 concrete. The McCrady-Rodgers Co. delivers batched aggregates by truck to a tower bucket which is raised to discharge into the mixer drum. A temporary bridge was constructed across the Turtle Creek to afford access to the plant from the street. Materials are batched by weight. Gravel was used in the pier concrete; but limestone is specified for arch ribs, columns, and deck. Concrete

for the sidewalk will be 1:2:3 mix.

Sacked cement is delivered to the plant by trucks and is stored in a shed. The cement for a batch is dumped into an end-tipover car which is pushed to the end of a narrow-gage track to discharge its load into the tower bucket.

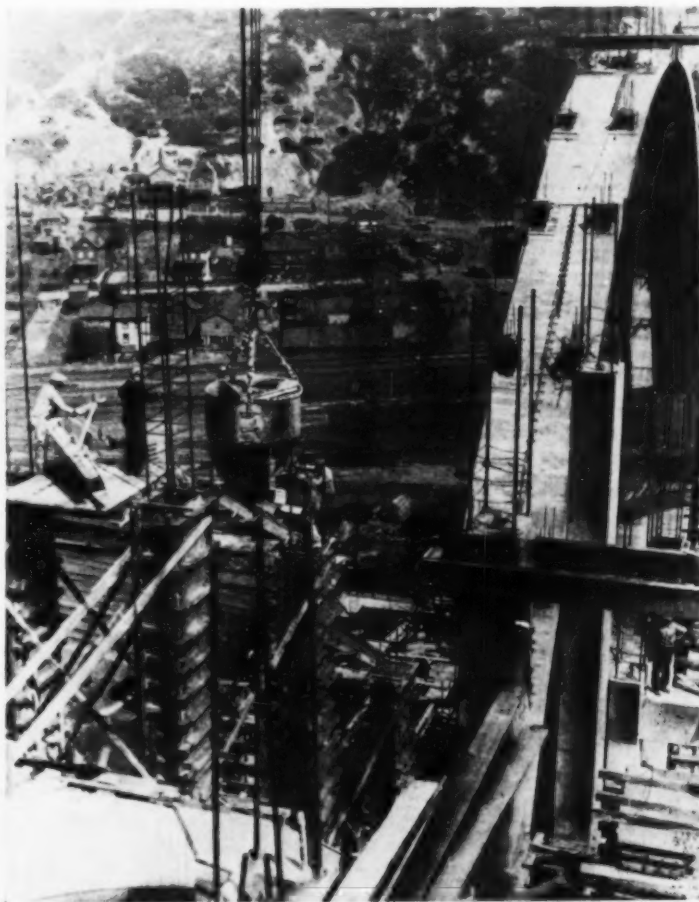
Mixed concrete is discharged directly into a 5-yd. bucket on a narrow-gage flat car of two-bucket capacity. The cableway deposits an empty bucket on the car and picks up a loaded one. A hoist-operated endless cable spots the car under the mixer and cableways.

Supervision—A. Rex Flinn is president of the Booth & Flinn Co., for which George Hockensmith is in general charge, with N. H. McLain as superintendent. R. A. Alexander as assistant superintendent, and Charles E. Whitcomb as job engineer. Under Norman F. Brown, director of the Allegheny County department of public works, and V. R. Covell, chief engineer of the bureau of bridges, S. R. Harper, assistant engineer, is in charge of construction for the county and state.

**[[NEXT MONTH—More pictures
showing progress of construction
on the Hoover Dam.]]**



5-YD. CONCRETE BUCKET is deposited on car at mixing plant by cableway. Cableway will pick up loaded bucket. Car is moved by hoist-operated continuous rope.



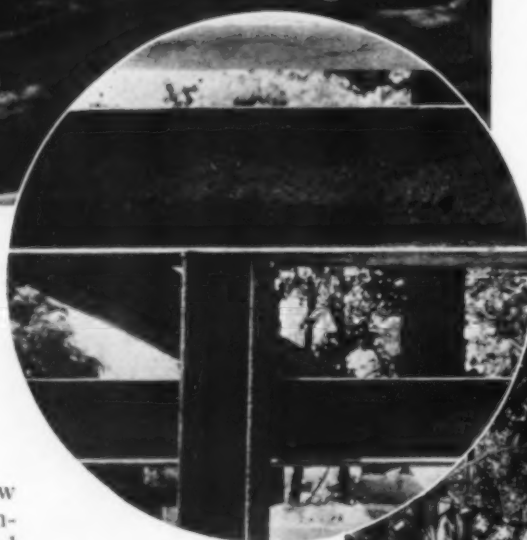
POURING COLUMN on north rib, Span 5, with 5-yd. bucket handled by cableway.

Seven-Room Steel Frame House

ERECTED BY ARC WELDING

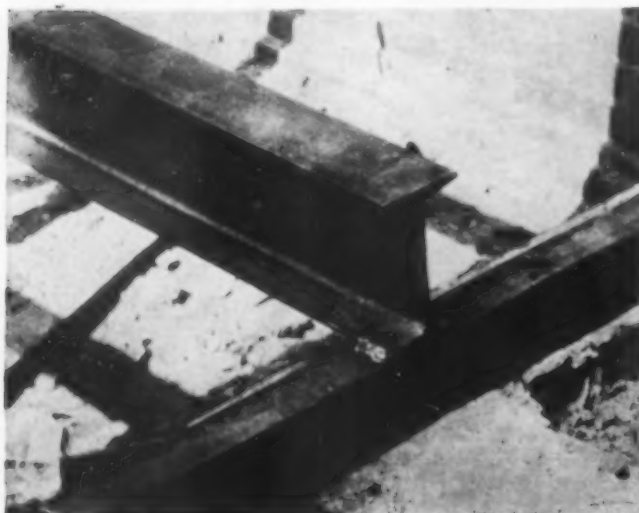


SILLS AND FLOOR JOISTS are, respectively, 3-in. 5.7-lb. and 6-in., 12.5-lb. Carnegie I-beams. Note 10-in. variation in levels of first floor.



BASEMENT COLUMNS, 4-in. I-beams, support 8-in. I-beams which carry the floor joists. Simple welded connection ties column to girder.

TO MEET requirements of low cost, simplicity of design and increased strength, insulation and permanence by the application of skyscraper materials and methods to residence construction, what is claimed to be the first house of complete arc-welded steel construction in the United States has been erected in the Shaker



TACK WELDS (*left*) are made at floor joist and sill connection. All but two connections are direct bearing joints.

Heights district of Cleveland from plans prepared by George Howard Burrows, architect. The seven-room structure, costing about \$25,000, is a two-story building of Norman-French design, involving the use of about 10 tons of steel in the framework.

Standard steel shapes cut to length at the mill included, principally, 3-in. lightweight Carnegie channels and 6-in. lightweight Carnegie beams. All fabrication and erection was done with Lincoln stable-arc electric welding equipment by the McKay Building Co., of Cleveland. The design made it possible for the steel to be delivered from mill to site and erected without punching or cutting. The cost of the house, according to Mr. Burrows, is 40 cents per cubic foot. On a basis of comparative estimates, the electrically welded steel-frame structure is said to exceed the cost of a comparable wood

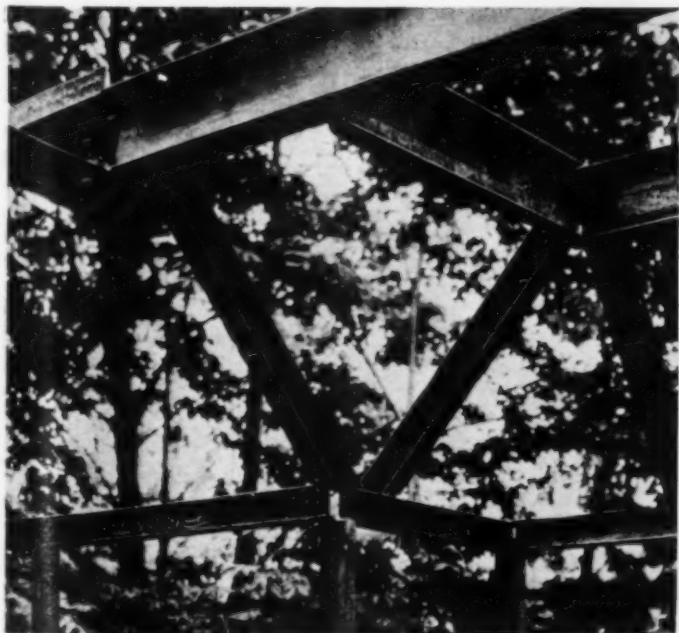


PLUMBING AND WELDING 3-in. channels serving as studs for first and second floors.



WALL DETAIL (above) showing 3-in. dead-air insulating space between outer shell of 4-in. face brick and inner shell of 2-in. hollow tile.

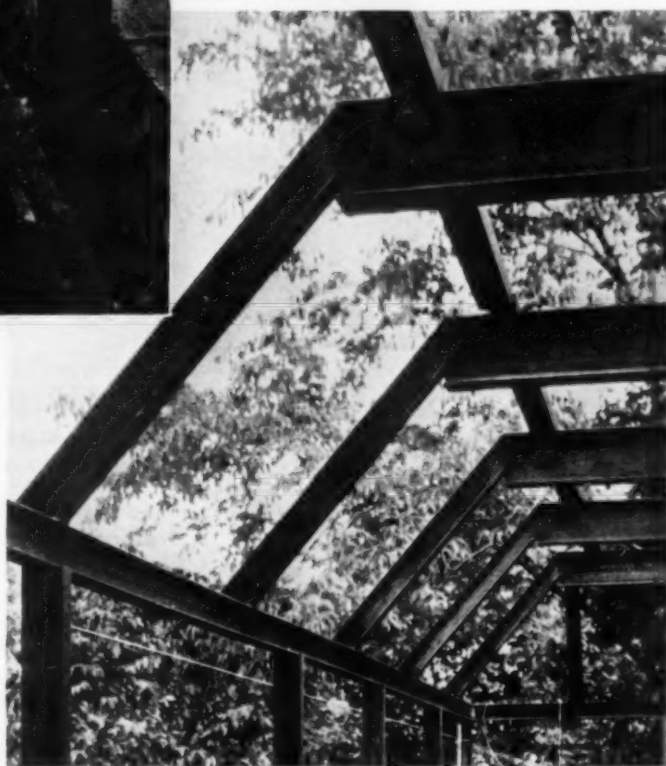
COMPLICATED FRAMING (below) of steelwork around offset in front exterior wall is required by Norman-French architecture.



frame house by only \$72. With one welder and three structural iron workers, approximately 4 tons of steel were erected during the first day of construction. The welding machine used was a portable, gasoline-driven unit. Steel erection was supervised by Louis K. Whitcomb, structural engineer for the Carnegie Steel Co.

Upon the masonry foundation 3-in., 5.7-lb. I-beam sills extend around the building and are welded to 3-in. I-beam

PITCHED ROOF (below) requires splice connection between 3-in. I-beams and 6-in. floor joists. Angles welded to top flanges of floor joists for lateral bracing. Splice joints, in shear, are only ones made on ground before erection.



ANGLES, arc-welded to floor joists, carry masonry for rear wall.

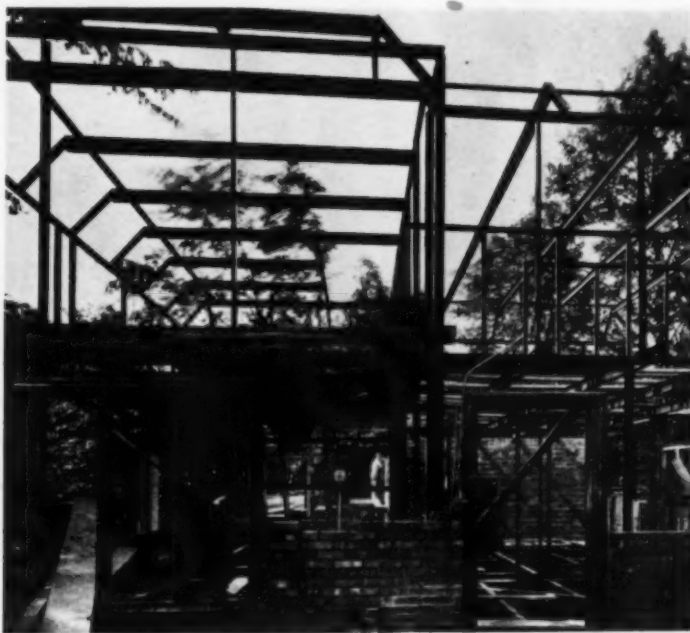
columns. Floor joists are 6-in., 12.5-lb. I-beams.

The wall construction consists of an outer shell of 4-in. face brick and an inner shell of 2-in. hollow tile. Brick is reinforced laterally with steel rods. The masonry is tied to studs with slips wedged on to the flanges of the channels. Insulation is secured by a 3-in. dead-air space between the inner and outer wall shells.

Ceilings are 2-in. poured concrete slabs reinforced with $\frac{1}{4}$ -in. steel rods. Across the steel floor joists, 2x4-in. wood sleepers are laid to support the sub-floors and allow for wiring or piping.

Among the advantages claimed for this all-welded steel-frame type of residence construction are strength, rigidity, low depreciation, resistance to fire, sound-proofness and reasonable cost.

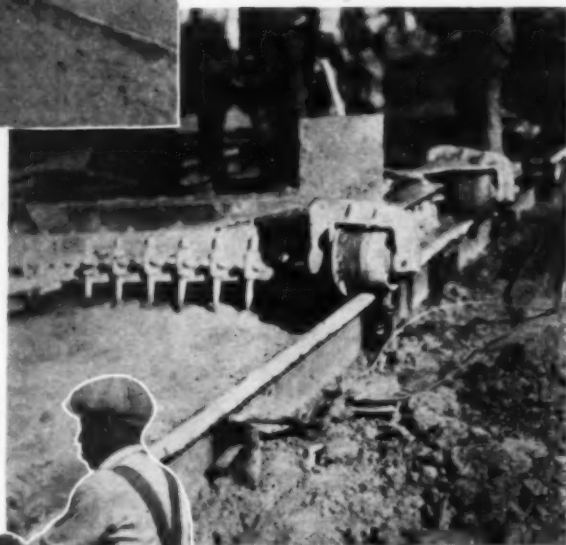
COMPLETED STEEL FRAME for seven-room house, showing masonry, doors and window frames.





STEEL STRIKEOFF, operated by finishing machine, levels concrete for wire mesh reinforcement. Man in background is pulling back one hauling rope to hook it to finishing machine.

Finishing Machine OPERATES STRIKEOFF *on St. Louis* *County Roads*



PULLEY SHEAVE, hooked to road form, carries hauling rope used to pull strikeoff.

HANDLE (right) at each end of strikeoff enables workmen to manipulate it easily.



AFTER STRIKEOFF HAS LEVELED CONCRETE, wire mesh is laid in place.

STEEL strikeoffs operated by movement of the finishing machines have been used by several contractors on St. Louis County roads to level concrete for installation of wire mesh reinforcement. St. Louis County pavement is designed with 42-lb. mesh 2 in. below the surface. Prior to the development of the strikeoff, contractors had been under considerable extra labor expense in leveling the first layer of concrete to carry the mesh. Extra labor still is required with the strikeoff; but the time consumed in the leveling operation is much reduced.

Moore Bros. Construction Co. of East St. Louis, Ill., and the William A. Riley Construction Co. of St. Louis, are two contractors who have used strikeoffs successfully in building concrete roads on St. Louis County's \$10,000,000 highway construction program, a bond issue for which was authorized in 1927. Construction started in 1928, and each year has seen an increasing expenditure. Approximately \$3,500,000 had been spent by Jan. 1, 1931.

Both the Moore and Riley contracts were for 9-7-9-in. concrete slab 20 ft. wide, with a metal center-line joint and 1-in. transverse expansion joints 100 ft. apart. Transverse steel contraction joints were spaced every 33½ ft. between expansion joints.

The steel strikeoffs were equipped with runners which rode on the forms and with handles at both ends. A man at each handle kept the strikeoff at right angles to the form as it was pulled ahead. The handles also enabled the men to tilt the strikeoff in passing over joint strips.

To pull the strikeoff a line at each side, reeved through a pulley block, was hooked to the finishing machine. The blocks were anchored to the road

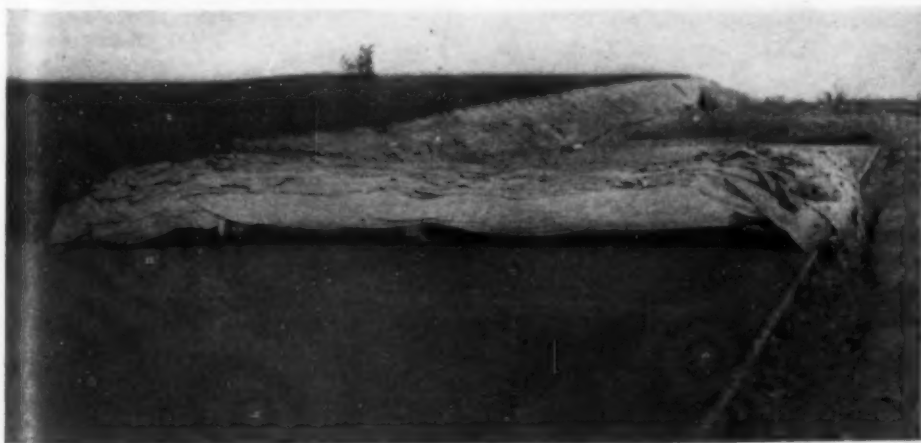
forms near the mixer. As the finishing machine moved backward, it pulled the strikeoff forward, leveling the concrete in a few seconds. After the steel mesh had been placed, additional concrete was dumped and the machine finished the surface.

Both contractors used Lakewood finishing machines and Koehring 27-E pavers, supplied with material by three-batch trucks. The Moore Bros. Con-



WILLIAM C. BERRY (left), consulting engineer, and **W. H. WHEELER**, materials and testing engineer, St. Louis County.

struction Co. paved $4\frac{1}{2}$ miles on Page Ave. from a batching plant on a railroad spur. A gasoline crane with a $\frac{3}{4}$ -yd. bucket handled sand and limestone into 15-yd. bins. The William A. Riley Construction Co. laid 4,000 ft. on Woodson Road with sand and stone hauled 7 miles from the Rock Hills quarry by the quarry company. Sub-grade planers attached to the mixers were followed by manually-operated scratch templates to check the grade.



BURLAP AND STRAW are used for curing slab.



THREE-BATCH TRUCKS serve 1-yd. pavers on both jobs.



THOMAS MOORE, in charge of job for Moore Bros. Construction Co.

Burlap was spread on the surface as soon as the concrete had taken its initial set and was kept wet for 24 hours. The slab was then covered with straw and allowed to cure for 7 days. Although specifications required 14 days before opening to traffic beam tests usually showed a high enough strength to permit opening at 10 days. High-early-strength concrete made with Prestolite cement was used at important intersections to obtain prompt reopening.

The slab was reinforced at each edge with a $\frac{3}{4}$ -in. round bar which was cut off at each transverse joint. Dowel



C. W. CURRY (left), superintendent, and **WILLIAM A. RILEY**, of William A. Riley Construction Co.

rods $\frac{1}{2}$ in. in diameter and 4 ft. long were used in the center-line joint at 5-ft. intervals, and $\frac{3}{4}$ -in. dowels 4 ft. long spaced 2 ft. apart were installed in the transverse joints. Half of each dowel was oiled at the transverse joints, and a metal sleeve was placed on the oiled half at the expansion joints.

VULCANIZED PATCHES

Maintain Asphalt Pavements

A TOTAL of 1,867,000 sq.yd. of asphalt paving from 9 to 42 years old in Fort Wayne, Ind., is kept in repair by a method known as vulcanized patching. The procedure, as illustrated in the series of pictures below, is simple, economical and practically fool-proof; it has been followed in Fort Wayne for the last 15 years. Using Texaco asphalt, the top mix-

By W. H. DROEGE
*Asphalt Paving Chemist
Fort Wayne, Ind.*

ture is produced at the city's 500-yd. plant. By the method illustrated the cost of patching, including materials,

hauling and labor, both at the plant and on the street, is less than \$1 per square yard. Pavement maintenance is carried on winter and summer. An asphaltic cement of high quality, not harder than 50 penetration, is used in preparing the mixture for the patching. A low-bitumen mixture would not stand manipulation by the vulcanizing method.



1 WORN AREA of asphalt pavement is cleaned and dried with blow torch of low heating intensity preparatory to painting edges of area with hot asphaltic cement applied by broom.



2 PAINTING EDGES with hot asphaltic cement is extended to width of 5 to 6 in. Center of patch is heavily sprinkled with pure asphaltic cement; cut-back asphalts are not used for paint coat in patching.



3 BLOW TORCH is applied rapidly up and down the edges and center of the patch to soften asphalt paint. Then hot mix is instantly applied and raked. Torch precedes smoothing iron, drawing paint coat through new mix along joint of patch.



4 VULCANIZED SEAL results when heat of blow torch draws asphalt paint through mixture to surface, causing perfect bond between edges of patch and existing pavement.



5 ROLLER compresses patch mixture after surface has received a light sweeping of portland cement to prevent asphalt paint sticking to roller wheels.



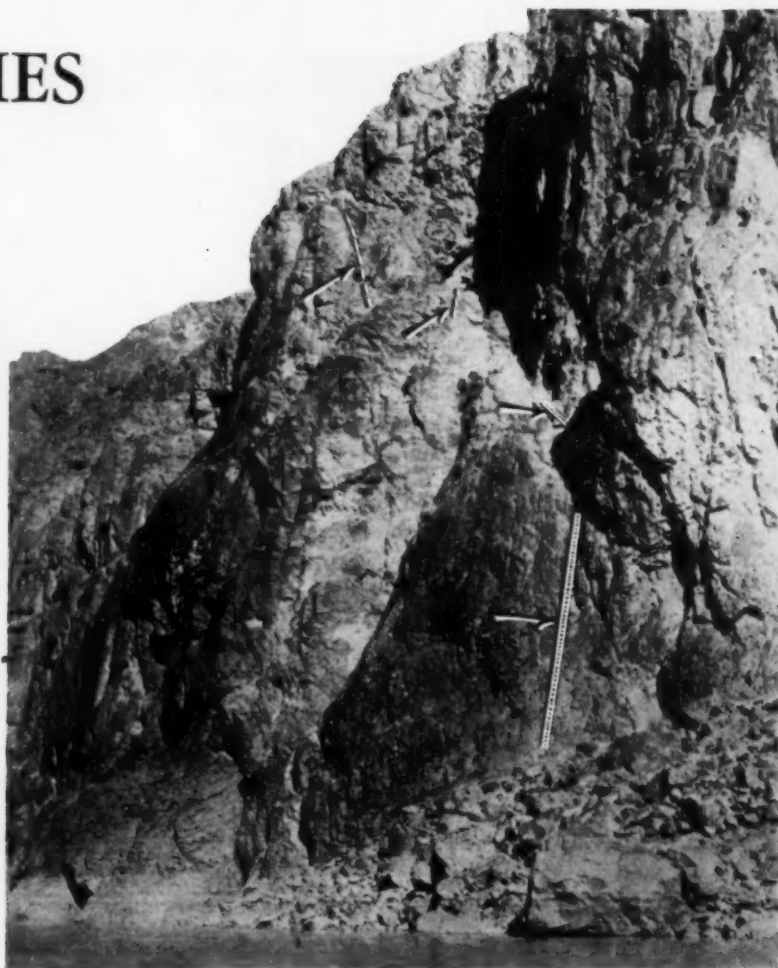
6 COMPLETED PATCH one year old. Many asphalt paving patches made by the method above outlined are in good condition after a service of 15 years.

JOB ODDITIES

A Monthly Page of Unusual
Features of Construction



TELESCOPED. New York subway excavation reveals steel pipe pile sections driven outside or inside other sections without fracture.



A LONG CLIMB is offered to Hoover dam workers by ladders extending 600 ft. along steep face of Colorado River Canyon

Union Pacific Photo



DUTCH SPEARHEAD (left). Long precast piles of reinforced concrete, with large pointed ends, are driven to support new skyscraper under construction near one of the numerous canals in Holland.

©Wide World

FOR TALKIE CONSTRUCTION (right). Fleet of 100 trucks and trailers delivers 1,800,000 ft. board measure of lumber to Universal Film Corporation studios near Los Angeles, Calif. Material is for use in building sets and stages for production of sound pictures.





Confidence!

TO the credit of the Link-Belt Shovel-Crane-Dragline let it be said that users have confidence in its builder and its performance—confidence that has been earned through the years, in all kinds of work.

Link-Belt has merited this confidence because of its policy of always giving more, not less than we promise.

Here is a case in point. The Torson Construction Company have purchased ten

Link-Belt machines since 1924. They have used them on all kinds of work, all over the country. Illustrated here is one of their five Link-Belt draglines on the Southwestern Outfall Sewer job at Louisville, Ky.

The good-all-the-way-through quality of Link-Belt Shovels-Cranes-Draglines makes friends that "stick". Charles M. Torson is one who says that the Link-Belt is the only machine he would ever buy. Link-Belt users usually repeat. That is "confidence".

LINK-BELT COMPANY

300 W. Pershing Road, CHICAGO

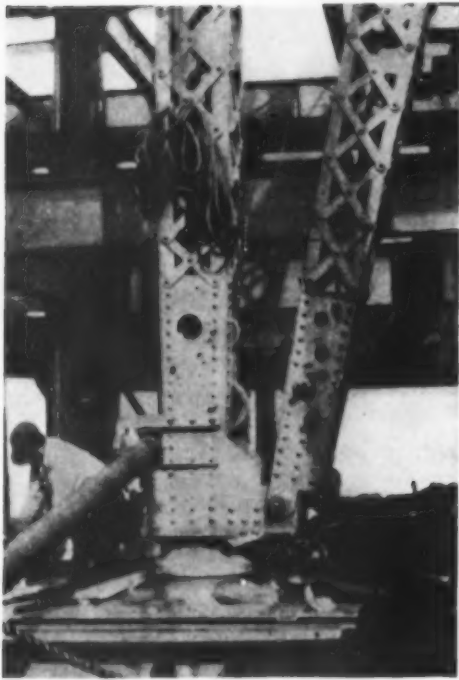
4352
Offices and Distributors in All Principal Cities



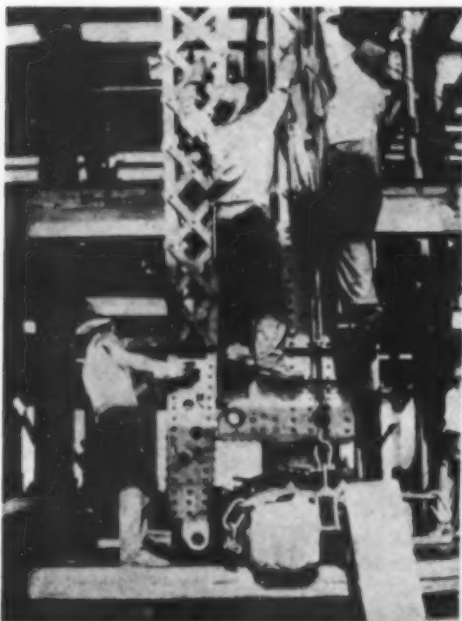
LINK-BELT

SHOVEL - CRANE - DRAGLINE

Step-by-Step JUMPING A



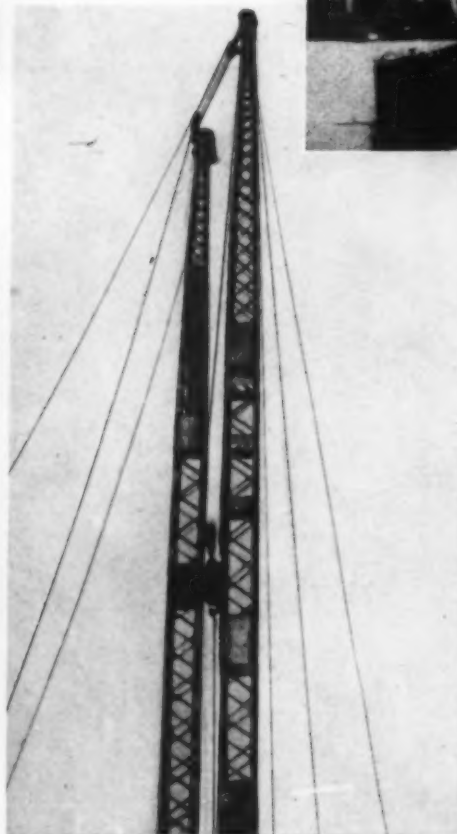
1 FOOT OF DERRICK is shown as steel is being erected for two floors above the one on which derrick is standing. As soon as all the steel for the two stories is erected, the—



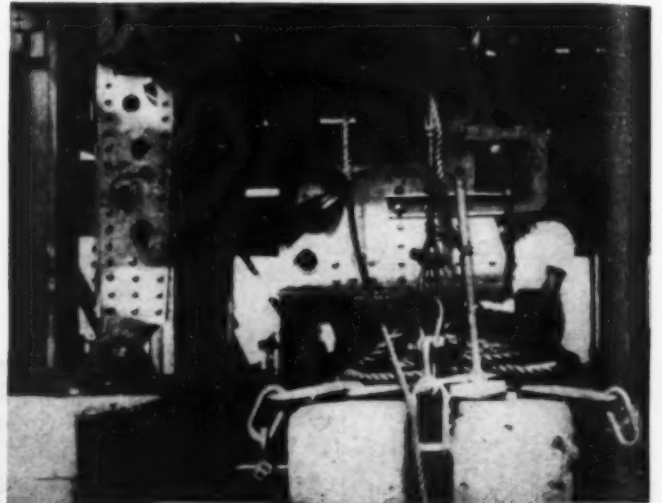
2 BOOM HEEL PIN is pulled out and boom is lowered, as shown. Foot-block has been temporarily fastened to mast with turn-buckles and shackles.



3 BOOM IS TURNED (right) 180 deg., and device is fastened to foot of boom with boom heel pin, to protect foot of boom which is then landed on timbers, as shown. Boom was turned 180 deg. so that—



4 LOAD FALLS can be hooked on to mast. Four jumping guys extend from top of boom to sets of falls to hold boom as a gin pole for raising mast. Load block is now between boom and mast instead of outside of boom.



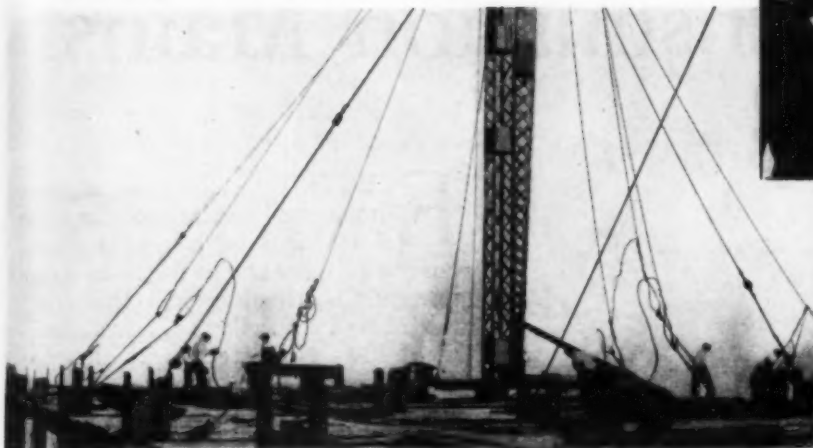
5 MAST HOOKED UP ready to be picked up by load cable.

BY WM. G. RAPP
Field Engineer
McClintic-Marshall Co.

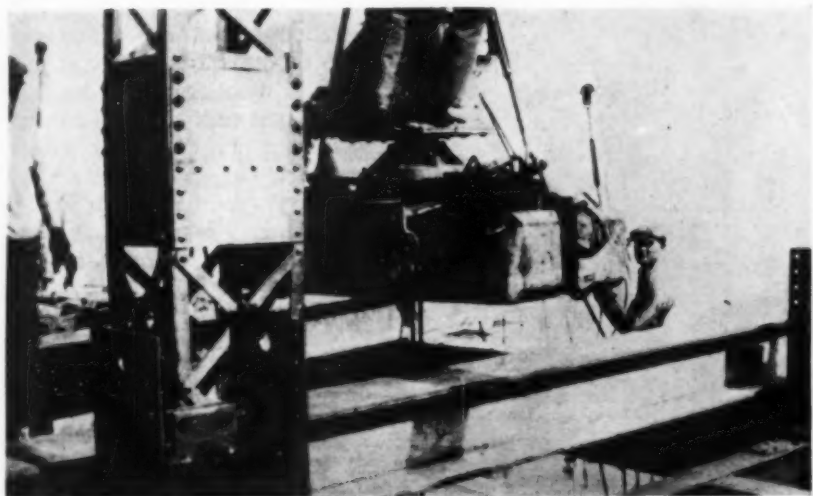
6 WHEN FOUR GUYS (left) have been fastened to boom, a slight strain is taken on load line and mast is thus held up by boom. Next, guys ordinarily holding mast are cut loose from columns on derrick floor and are brought up two floors and fastened anew in readiness for new position of mast.

Field Methods

GUY DERRICK

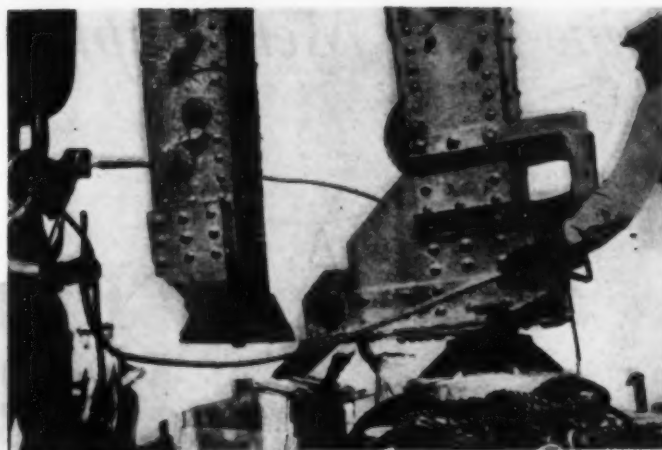
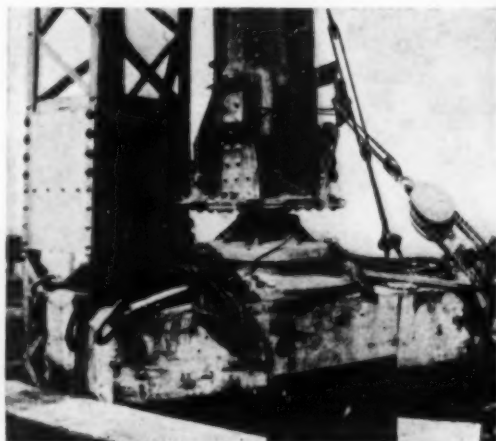


7 ENGINEER now goes ahead on load line cable and mast is picked up by load line, boom acting as gin pole. Mast guys are gradually taking up slack so that, when mast is up, guys on it will be all ready to go to work. Falls hold guys to top of boom.



8 FOOT OF MAST is raised a little higher than the two steel beams on which derrick is supported at each stage of erection. These beams have been spread enough to let the foot-block come up.

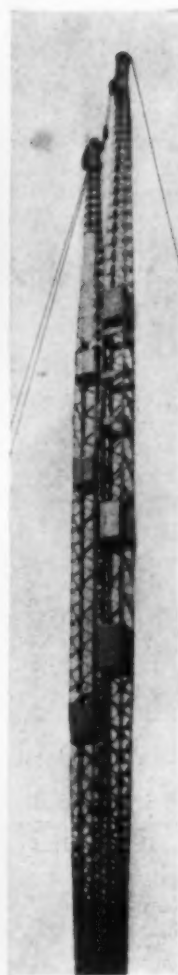
9 SLACKING DOWN (right) foot of mast to rest on steel jumping beams. Next, guys to top of boom are all made tight and four guys which held boom as gin pole are cut loose. Engineer now goes ahead on boom falls cable, and instead of boom booming-up, head of boom is drawn directly upwards to top of mast.



10 BOTTOM OF BOOM has been pulled up by mast. Note device to protect foot of boom. Next, by putting sling around foot of mast and hooking it up to the load hook and—



11 GOING AHEAD ON LOAD LINE (above), foot of boom is pulled over to mast and when in its proper position pin is inserted.



12 DERRICK IS READY (left) to go to work again. Derrick shown has a 90-ft. mast, 80-ft. boom and is one of two used by McClintic-Marshall Co. in erecting the structural steel in the Radio Corporation of America Building, New York City.

Pipe-Line Men Improve Methods of Constructing Large Gas Transmission Mains

Part IV

Electric Welding, Cleaning and Covering Pipe



ON 26-IN. SOLID-WELDED LINE from Kettleman Hills to Los Angeles, ditching crew precedes lining-up gang, and pipe and rollers are mounted on cross-timbers over trench.

TACK WELDING JOINT (right) with four 2-in. welds spaced equally around pipe.



FIRING-LINE GANG equipped with four Lincoln portable gasoline-engine-driven units welds over mile of 20-in. line each day. Generating machine is 400-amp., driven by six-cylinder motor, and is equipped with device which automatically idles engine 10 sec. after arc is broken. When arc is restruck, engine speeds up instantly. Device saves gasoline.

ELECTRIC welding is a most important method of making field joints on large gas transmission pipe lines. On the 24-in. Continental Construction Co.'s line from the Texas Panhandle to Chicago, made up of 40-ft. pipe lengths with alternate welded joints and Dresser couplings, about 402 miles was electrically-welded in the field and about 480 miles at plants of the steel companies furnishing the pipe, by the Welding Engineering Co., of Bartlesville, Okla., the A. O. Smith Co., and others.

Development of the shielded-arc process and of high-speed welding electrodes has increased the rate of joint construction and encouraged a speeding up of other operations. According to field data assembled by the engineering department of the Lincoln Electric Co., one welding crew using Fleetweld electrode can maintain a conservative average of nineteen joints on 20-in. pipe per 9-hour day. Some units have averaged 30 joints a day

FIRST STEP (below) in welding joint is to insert backing-up ring in one pipe section, on rollers, tack ring to pipe with one weld, and fit next section on ring. Tack weld which fastens ring to first pipe can be seen at top of joint.

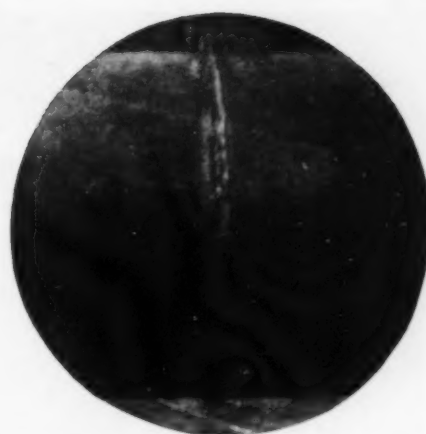


on 20-in. pipe. Use of 18-in. electrodes instead of the old 14-in. length helped to speed up welding by eliminating frequent changing of electrodes.

In the shielded-arc process the electrode is coated with a special composition which burns in the arc, excluding air and practically eliminating oxides and nitrides which cause porosity, brittleness and poor ductility of weld metal. The coated electrode also deposits a layer of easily removable slag which protects the metal while cooling. Used at the maximum welding current, the electrode obtains deep penetration and more perfect fusion. The maximum time for making each connection with the shielded arc is figured at 1 min. per inch diameter of pipe.

For gas transmission mains, plain butt-end pipe bevelled at 30 deg. is used. The joints are backed up with a chill ring. Formerly, the sections

CORRUGATED EXPANSION JOINT (indicated by arrow, below) is used in 26-in. California line. Solid-welded lines require provision for expansion. Hose connection is for initial pressure test on welded section.



BURNING IN OR STRINGER BEAD after scaling. Two beads are made at each joint, first being stringer bead, welded with $\frac{1}{4}$ -in. or $\frac{5}{16}$ -in. electrode. Helper scales this bead while operator welds next joint along line, pipe being turned simultaneously for both operations.

BELL-HOLE WELDING CREW (right) ties sections into line. As pipe cannot be turned for this joint, operator, starting bead at top, welds around half of circumference and then repeats operation on other side while helper scales completed bead. Three to five beads are used for tie-in welds.



SHIELD on pipe protects arc from wind and remains stationary while pipe is turned. Operator wears head shield and split-leather apron. Each unit, manned by one welder and one helper of Welding Engineering Co., Bartlesville, Okla., makes 50 welds per day, joining 40-ft. lengths of 24-in. pipe into 80-ft. sections, at yard of L. E. Myers Co., Chicago, contractors on portion of Continental line.

were lined up on skids, but use of rollers to facilitate turning the pipe has made greater speeds possible.

Preliminary Operations—The line-up gang uses a small crane to handle the pipe. After a pipe section has been placed on rollers, the backing-up



TYPE OF ROLLERS on which pipes are mounted to be turned easily during welding.

ring is inserted in one end and is tacked to the pipe with one weld. The gang then fits the next section on the ring.

Following the line-up gang is the tack-welding crew, which joins the two pipe sections with four 2-in. welds spaced equally around the pipe. This crew used $\frac{1}{4}$ -in. or $\frac{5}{16}$ -in. electrodes.

Welding Joints—Final welding of joints is performed by the firing-line gang, which is made up of from three to five units. Each unit consists of a portable gasoline-powered electric generator, a welder, and two helpers. One helper turns the pipe with a chain wrench while the other scales and brushes the bead.

Two beads are made at each joint.



CLEANING PIPE on Henry Lemons, Inc., contract section of Continental line. Pneumatically-operated wire brushes are driven by air from Davey compressor mounted on Caterpillar tractor. Cup grinders are similarly operated to smooth rough welds before painting.



FOR LINES UP TO 12 IN. IN DIAMETER, W-K-M pipe cleaning and priming machine removes rust and dirt from surface and applies prime coat for enameling. Wheel on axle at side keeps machine on even keel.

The first, called the burning-in or stringer bead, is welded with $\frac{1}{4}$ -in., $\frac{5}{16}$ -in., or $\frac{3}{8}$ -in. electrodes. A helper scales the bead while the operator welds the next joint. Electrodes of

$\frac{5}{16}$ -in. or $\frac{3}{8}$ -in. diameter are used for the finish bead.

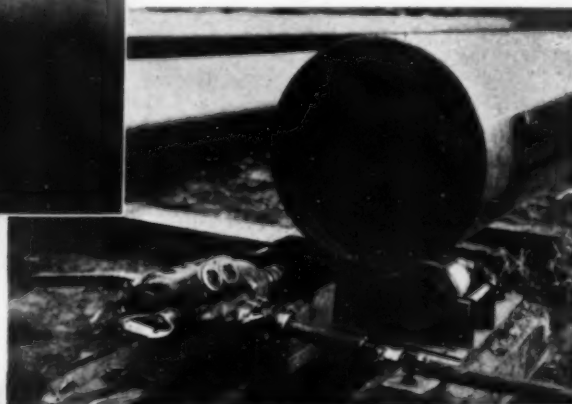
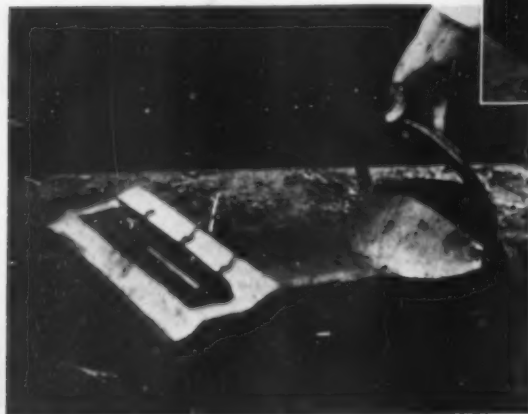
Tie-in welds are made by the bell-hole crew, as illustrated by one of the photographs. A tie-in weld consists of from three to five beads.

Mechanical Developments—Notable improvements have been made recently in methods of cleaning, priming, enameling and wrapping pipe. The light, tractor-mounted air compressor has proved a convenient and easily

METAL SPREADER (*right*) attached to pouring can applies hot Wailes Dove-Hermiston bitumastic enamel to 24-in. pipe. Extreme edge of spreader is curved to obtain practically line contacts between spreader and pipe. Equipment eliminates extra man and distributes enamel more evenly than older methods.



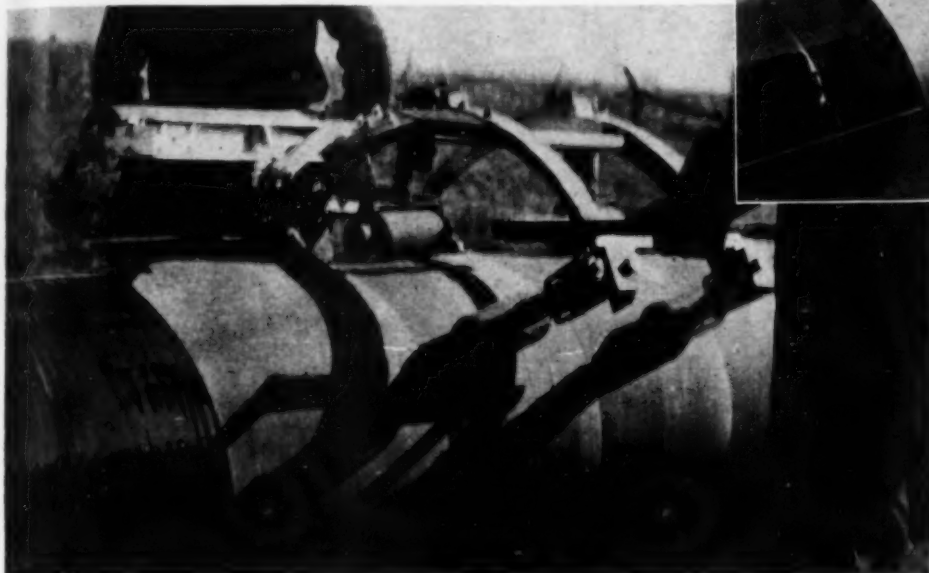
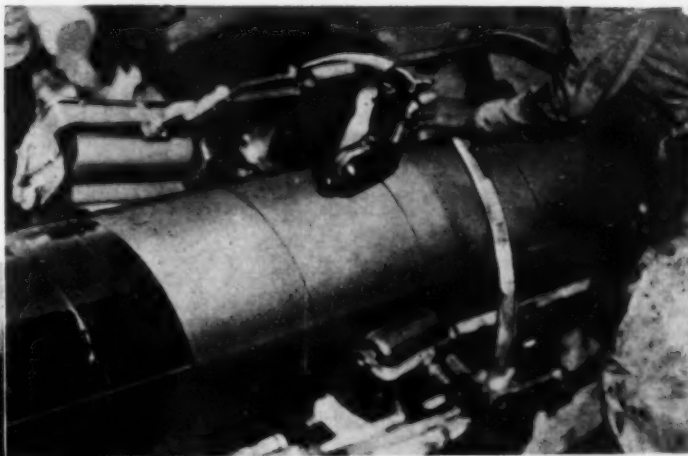
CENTER CUTOUT (*left*) on spreader controls flow from pouring can to pipe.



AIR-POWERED TURNING RIG (*left and above*), operated by 142-cu.ft. air-cooled Davey compressor mounted on Caterpillar tractor, revolves pipe at uniform rate during application of hot enamel, eliminating extra labor and facilitating even coating of pipe for Williams Bros., Inc. Tractor-compressor outfit is many-purpose unit, being equipped with air-driven boom hoist which handles and spots pipe.



ROTARY-TYPE PIPE-WRAPPING MACHINE (*right*) applied Johns-Manville asbestos felt with 1-in. lap at the rate of 15 ft. per minute on solid-welded line. Machine, developed by Johns-Manville and W-K-M companies, consists of circular angle frames carrying roll of felt and riding on spring-mounted rubber rollers which iron felt as it is applied. Hinged frame facilitates removal from pipe. Two men operate machine, which weighs about 400 lb.



SADDLE-TYPE PIPE-WRAPPING MACHINE (*left*), of Johns-Manville and W-K-M origin, is used on lines having coupled joints. It resembles upper half of rotary type; but it is not revolved around pipe. Pipe is rotated by turning rig while two operators walk along with wrapping machine riding on top of pipe.

mobile power supply for rolling rigs to turn the pipe and for pneumatic brushes and grinders to clean it. In addition to these services, the tractor-compressor unit often is equipped with an air-driven boom hoist to handle pipe. The use of the air drill for turning the rolling rig is one instance of

the possibilities which the compressor has brought into the pipe-line field. The compressor feature in no way interferes with the use of the tractor for drawbar work or other purposes. A W-K-M machine which travels on the pipe has been perfected to clean lines up to 12-in. in diameter.

An ingenious air motor, illustrated herewith, turns the rollers while the

pipe is being enameled. A metal spreader attached to the pouring pot has increased the efficiency of the enameling operation. Pressure spraying equipment has demonstrated its advantages over the brush method of applying primer. Wrapping machines have been developed, as illustrated, for solid-welded and for couple lines.

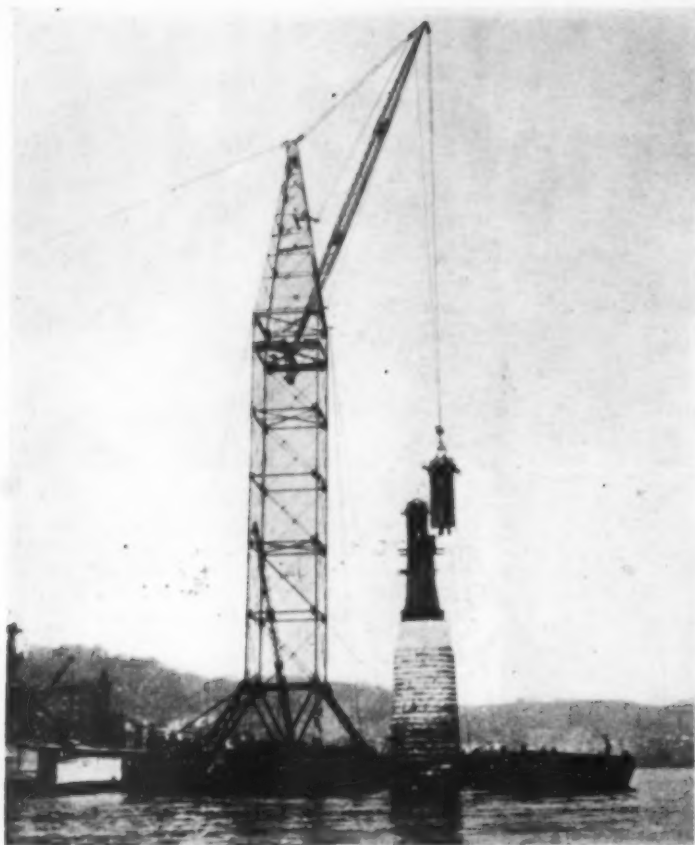
Wrapping machines of the types illustrated not only give a tighter job, with a more uniform lap than was possible with hand wrapping, but they also are faster and more economical. A rotary machine can wrap 1 to 1½ miles a day with two pairs of men.



COUPLING COATER in position on 18-in. Texas line of United Gas Co. Semi-circular pan is held tightly against bottom half of pipe by chains attached to levers. Operator pours hot Wailes Dove-Hermiston coupling coating over all parts of upper half. Excess runs down into pan until pan is full, thus coating full circumference of coupling, as well as several inches of pipe on both sides. After coupling is thoroughly coated, valve in bottom of pan is opened, and hot coating drains out into pail hung under pipe.



SPRAY-PAINTING OUTFIT applies cold prime coat to one-third of pipe, operators walking length of section three times and finishing at far end. Binks outfit consisting of three nozzles mounted on knife-edged wheels has several adjustments for regulating spray and coating pipe from 12 to 30 in. in diameter. Material pressure container of 65-gal. capacity and 36-cu.ft. gasoline-engined air compressor weighing 790 lb. are carried on truck or wagon. Third man walks with operators, carrying air-conditioning unit, air hose and primer hose. It is claimed that crew totaling seven men can prime-coat 5 miles of 24-in. pipe per day and obtain 4,300 lin.ft. of coverage from one barrel of primer.



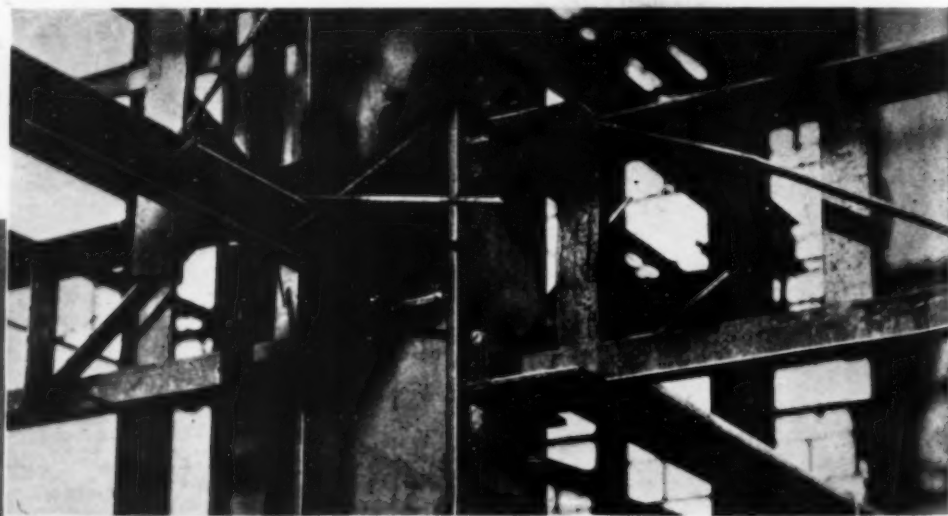
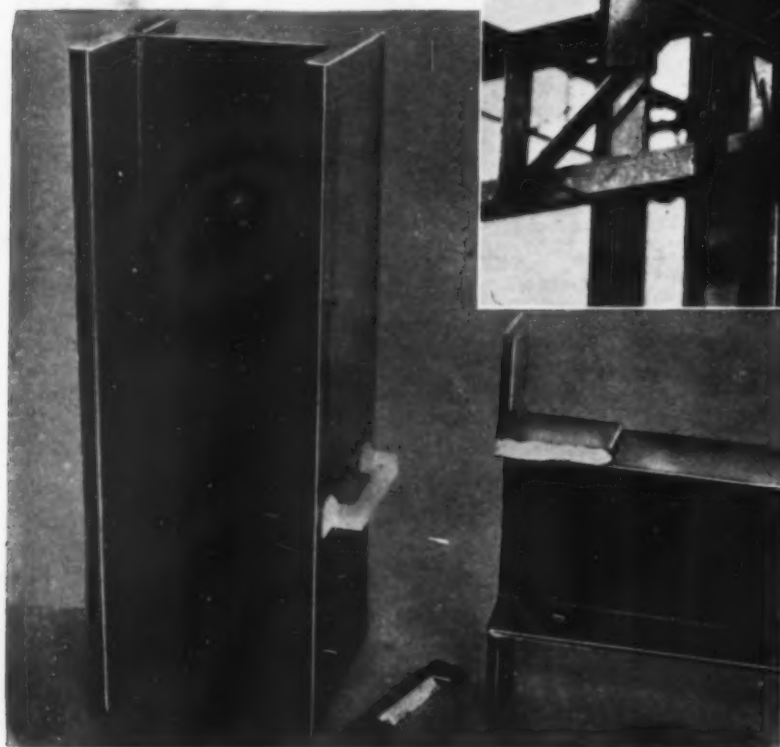
FLOATING DERRICK TOWER, handling loads up to 25 tons, facilitates erection of two main towers of Maysville-Kentucky bridge by John A. Roebling's Sons Co., contractor for superstructure and suspension cables. Structure across Ohio River has main span of 1,060 ft. Each of two bridge towers carrying suspension cables contains 350 tons of steel. Each of two derrick towers, involving 85 tons of structural steel, is mounted on two steel barges, lashed together. Each derrick tower, 200 ft. high above water level, is equipped with 125-ft. boom. Erection of derrick towers for Kentucky and Ohio sides of the river work required $3\frac{1}{2}$ and $4\frac{1}{2}$ days respectively.

Getting Down to DETAILS

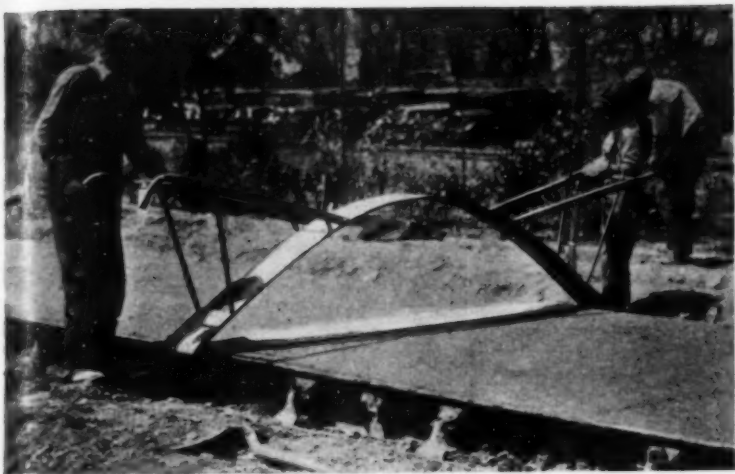
[[Close-up Shots of
Job Methods and Equipment]]



SQUEEGEE CART applies hot asphalt filler to joints of brick pavement in Cuyahoga County, Ohio. Two-wheeled Littleford unit has squeegee of heavy belting and introduces filler into joints under pressure. Asphalt, heated to 375 deg. F. in large tank, is delivered in buckets to squeegee cart. Slag screenings are spread on jointed pavement while thin surface film of asphalt is still hot. Fred R. Williams, county engineer.



SIMPLE ERECTION SEAT (at right and above), shop welded to columns and beams, eliminates use of punched holes and field bolts during construction of arc-welded steel frame for 18-story Allied Arts building, Lynchburg, Va. Beams are supported in erection seat by angles or split I-beam stubs welded to beam flanges. Erection seat is beveled on inside toward column or beam to which it is connected so that weight of floor member forces angle tightly against column to which it is to be welded. Erection seat illustrated was designed by Van Rensselaer P. Saxe, of Baltimore, Md. C. W. Hancock & Sons, of Lynchburg, Va., were the general contractors.



BOW FINISHER completes surfacing of concrete pavement on Mt. Vernon memorial highway near Washington, D. C. Handles facilitate operation of device by two workmen.



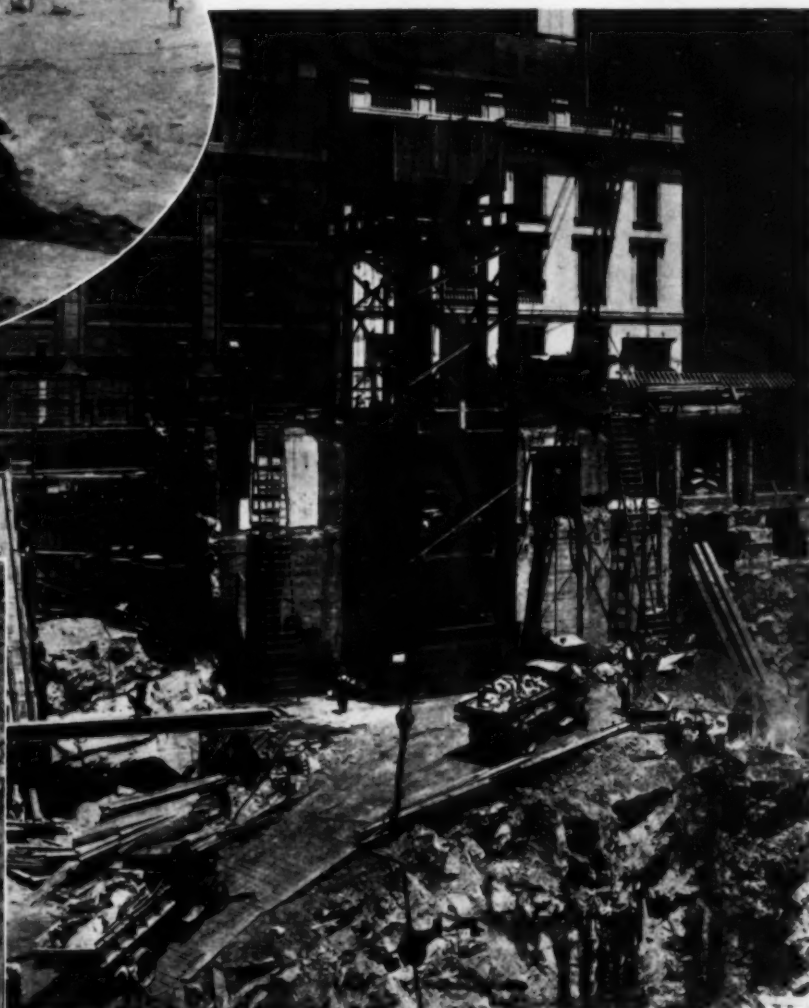
WRAPPING CABLES of St. Johns suspension bridge across Willamette River, Portland, Ore. Each cable consists of 91 strands of 1½-in. Roebling cable with fillers of cedar. Special machine wraps cables with No. 9 galvanized wire.



BALLOON TIRE PRESSURE of only 15 to 20 lb. per square inch enables eight trucks of Robert G. Lassiter & Co., of Raleigh, N. C., to traverse fine sea sand on sand-asphalt road construction along coast line of North Carolina. With ordinary higher tire pressures the trucks stalled. Low pressure in tires saved contractor cost of constructing temporary roads.



REMOVABLE HEAD simplifies pressure test of 250-mile 20-in. welded gas pipe line of Pacific Gas & Electric Co. in California. Test head comprises external band, rubber gasket and internal ring fastened by set-screws.



ELECTRIC ELEVATOR raises trucks from foundation to street level on Metropolitan Life Building, New York, under construction by Starrett Bros. & Eken, Inc., contractors. Steel head frame and vertical hoisting equipment take the place of the usual steep ramps for handling loaded and empty trucks on large skyscraper construction job in midtown New York.

JACKS

Raise 3,300-Ton Bridge

11½ Ft. to New Grade

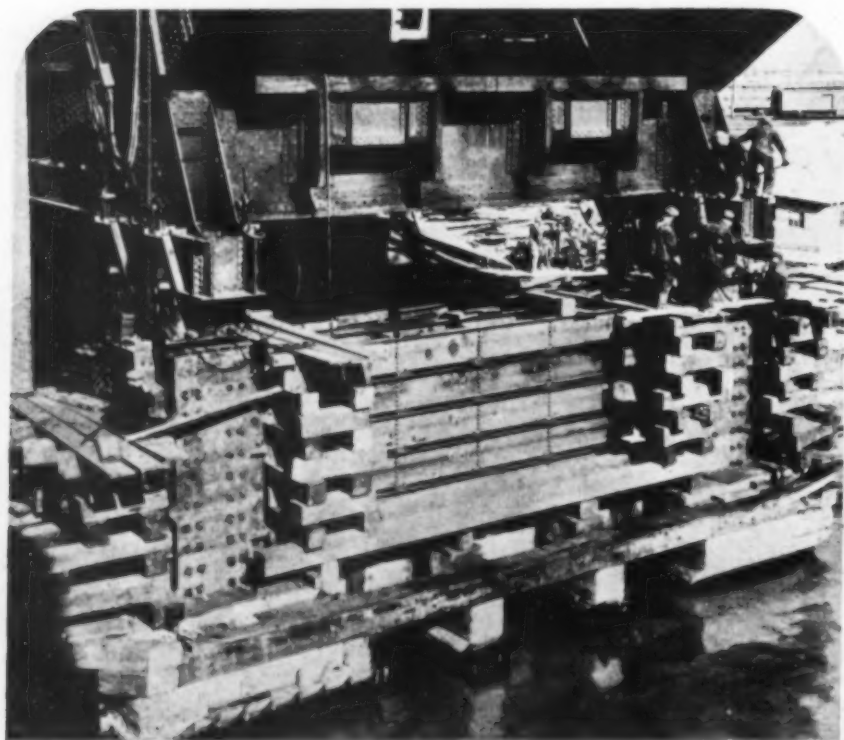
INCIDENT to rearrangement of railroad facilities at Chicago, Ill., a major bridge-jacking operation was performed by the Baltimore & Ohio Chicago Terminal Railroad Co. The general project involved the relocation of the South Branch of the Chicago

the bridges, and the contract let by the Baltimore & Ohio Chicago Terminal Railroad provided for construction at

By P. G. LANG, Jr.,
Engineer of Bridges,
Baltimore & Ohio, Chicago
Terminal R.R. Co.

either level. Due to the general situation, the bridge was built at the low level, but provision was made in the design to facilitate its subsequent elevation.

The principal features of this project are apparent from the illustrations at the bottom of p. 55. The lower picture, looking westward from the river, indicates the present and future disposition of approach tracks. To the left appears the St. Charles Air Line viaduct; to the right the uncompleted viaduct of

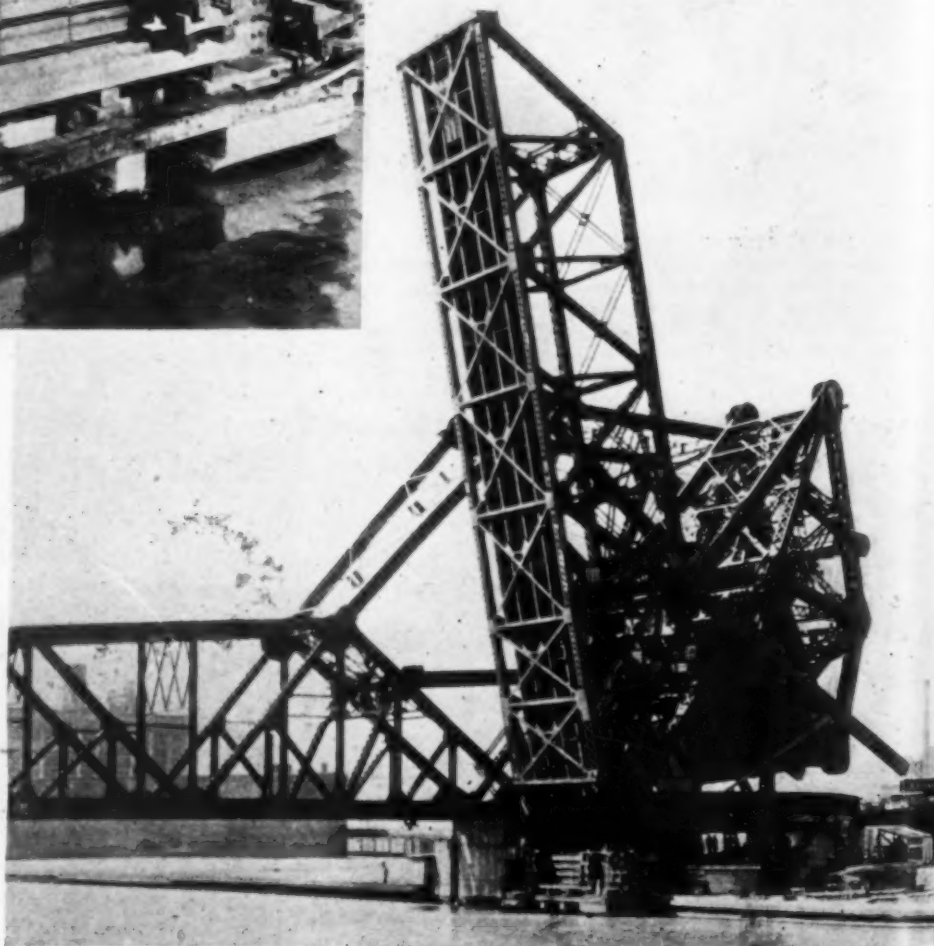


IN RAISED POSITION. Movable span of bridge after jacking had been completed, showing details of metallic substructure, with all castings in place.

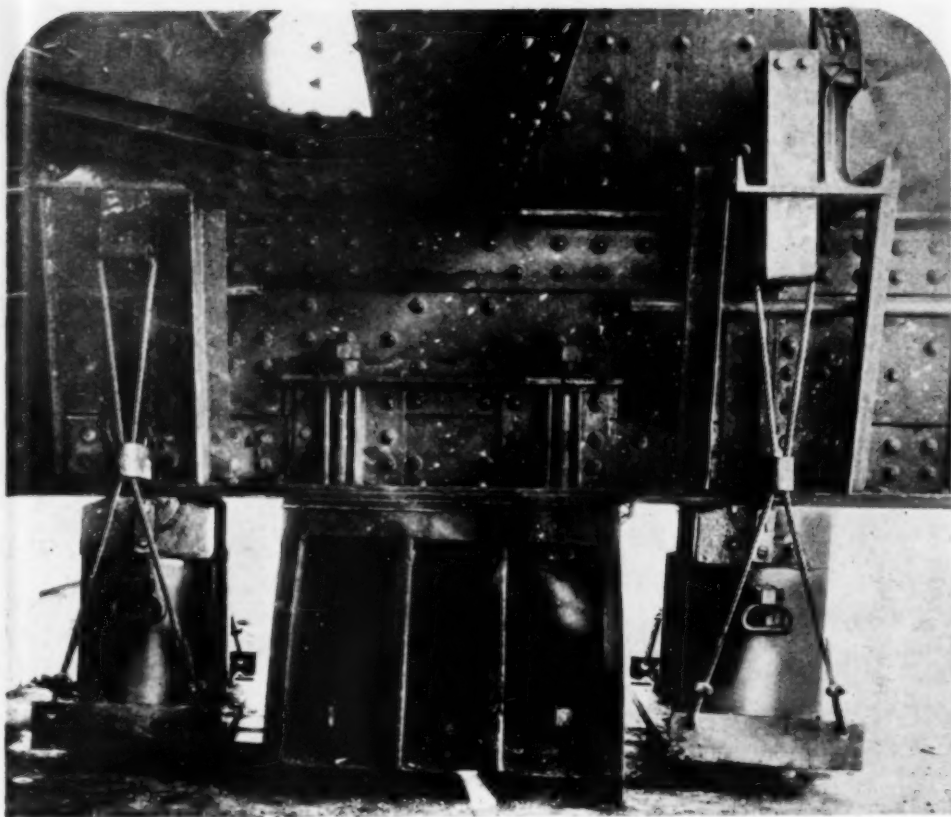
River, the reconstruction and shifting of the affected bridges.

During 1928 the Baltimore & Ohio Chicago Terminal Railroad began work upon its new bascule bridge, designed to cross the relocated stream, and this structure was completed during the summer of 1929, before the new channel had been excavated. After the completion of this work, and the diversion of the waters, the St. Charles Air Line bridge was dismantled and re-erected in its new location.

An important phase of the improvements in this vicinity was the separation of railroad grades at Stewart Ave., west of the river crossing, which involved the raising of the railroad tracks. The effect of this raise had received consideration in the arrangements for



DURING JACKING OPERATIONS bridge was maintained in open position. A 25-mile gale during one day of jacking caused no difficulty or difference in the reactions.



INSIDE OF MAIN TRUNNION SHOE, with original pedestal in place. Jacks are mounted on 1½-in. steel tray carriers, the first step in operations. Note rocker heads on jacks.

the B.&O.C.T.R.R., with temporary connection to permit the use by its trains of the St. Charles Air Line structure. The crossing of the Pennsylvania tracks is also shown. The upper photograph, looking eastward, shows the disposition of tracks leading to the Grand Central Depot, including the temporary connection of the B.&O.C.T.R.R., which curves sharply to the left. To the left are the approach spans of the B.&O.C.T.R.R. bridge; the old channel of the Chicago



LOOKING EAST from top of Air Line bridge, showing tracks leading to Grand Central Depot. In foreground fill is made for roadbed at higher level of raised bridge.



LOOKING WEST (left) showing Air Line viaduct at left and B. & O. C. T. viaduct at right, crossing Pennsylvania tracks in foreground.

River appears in the center, and the fill placed to accommodate the tracks at the higher elevation is also shown. The view includes connections with the New York Central, C.R.I.&P., Michigan Central and Illinois Central.

The actual work of jacking the B.&O.C.T.R.R. bridge to the new grade, a vertical distance of 11½ ft. was preceded by careful studies. The total weight to be lifted, including the steel superstructure, concrete counterweight, timber floor, machinery and electrical equipment was estimated at 3,330 tons. It was possible, by means of gages attached to the lifting mechanism, to ascertain the actual weight of the structure during the jacking operation, and this was found to be 3,370 tons, a variation of less than 1½ per cent.

For the jacking, eight 300-ton jacks and eight 500-ton jacks were used. Four of the 300-ton jacks were furnished by the jacking contractor, and the railroad company purchased the remaining jacks, consisting of four 300-ton and eight 500-ton. The equipment purchased also included a 35-hp. 4-plunger hydraulic pump, electrically-operated, capable of delivering 1,000 cu.in. per minute, at 8,500 lb. per square inch pressure, and the requisite

pipe lines for the distribution of water.

The successive stages of the lifting process were accurately determined in advance, and an articulated substructure, consisting of approximately 220 tons of iron castings, made to suitable dimensions, was purchased, together with about 97 tons of structural steel, for use in stabilizing the columns of castings which formed the supporting media, and in completing the framework for the symmetrical concrete-metal substructure which was formed to carry the bridge in its elevated position. During the jacking, with the movable span in the fully-open position, a wind velocity of 25 miles per hour was noted during one day, but no ill effect was produced.

When the bridge was originally constructed, the needs of the subsequent jacking operation received due cognizance, and the metallic superstructure was supported on a series of I-beam grillages, which left free spaces beneath the projecting corners of the superstructure, into which the jacking mechanism was subsequently placed.

The power for lifting the bridge was applied at four points, two beneath the main trunnion, adjacent to the river, and two beneath the counterweight trunnion, a short distance west of the river bank. At each of these points four jacks were concentrated, the 300-ton jacks being used beneath the main trunnion and the 500-ton jacks beneath the counterweight trunnion. The fluid used for operating the jacks was water.

It was anticipated that, incident to the jacking process, some tilting of the span might occur, and to prevent bending and secondary stresses, rocker

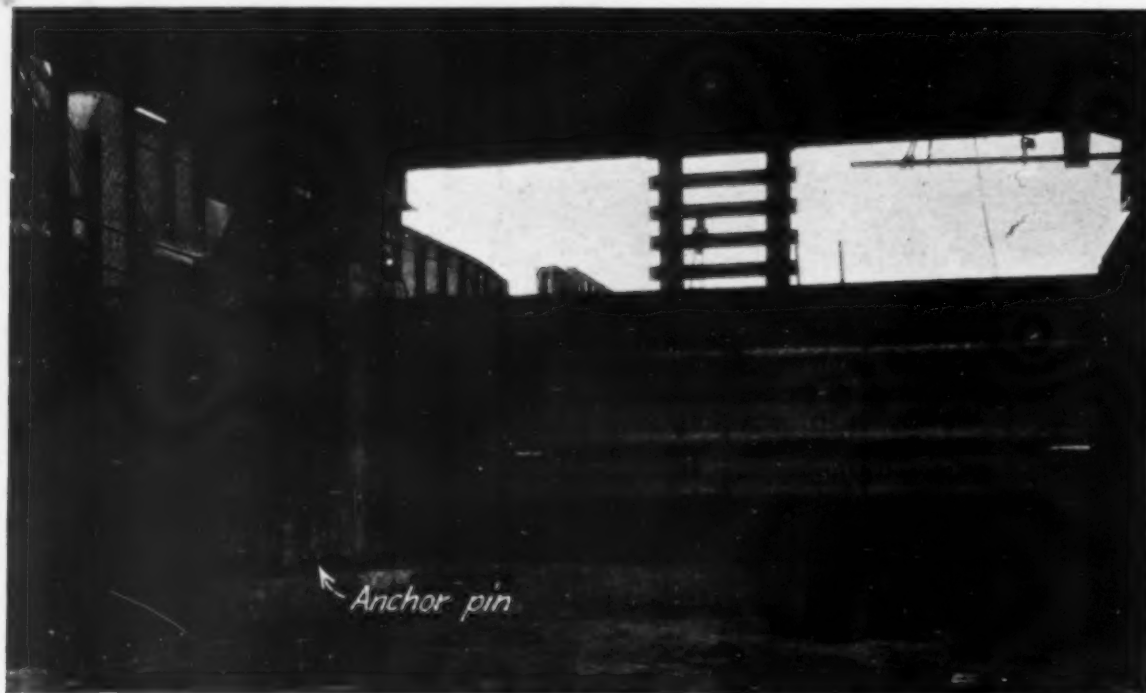


MAIN TRUNNION SHOE raised 21 in. and held by three 6-in. castings and three 1-in. plates. Main trunnion was held at this height during insertion of 21-in. castings over rocker shoes and jacks at counter weight trunnion.

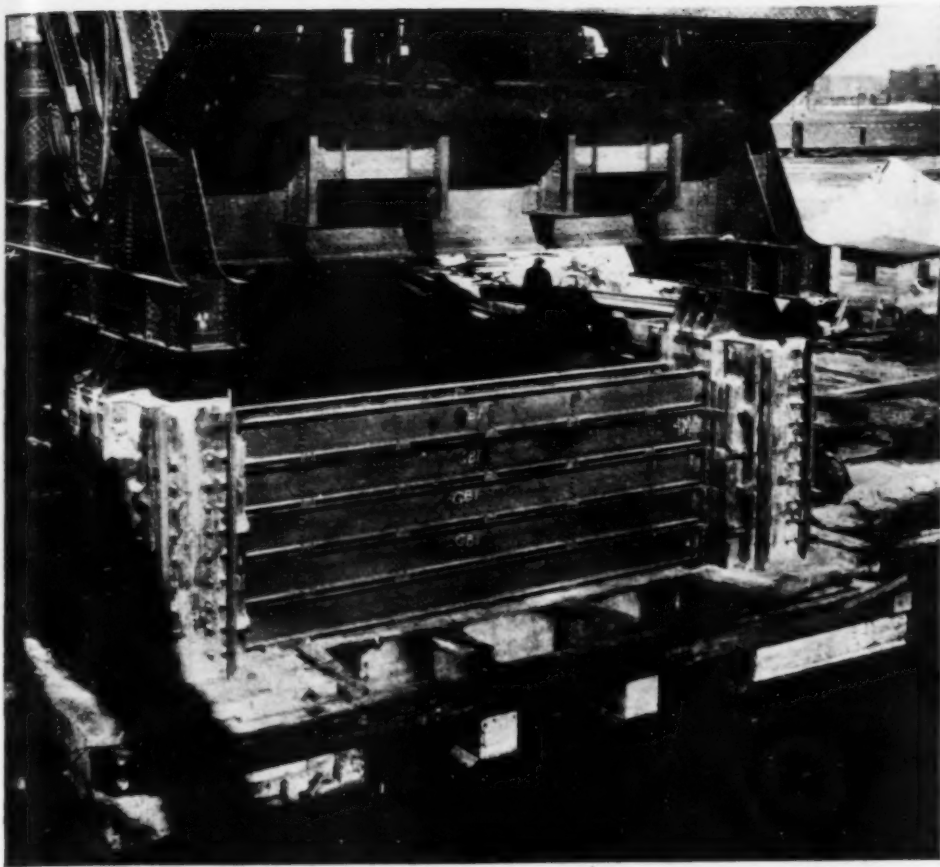
shoes were used and each jack was equipped with a rocker or tilting head. During the progress of each run-out shim plates were inserted around the plungers beneath the rocker heads of the jacks, in order to preclude any possibility of ill effect due to failure of power or mechanism.

All preliminaries being completed, the equipment carefully tested at the shop, and also, after assembly, in the field, the actual work of jacking was begun April 22. The power was applied, and a 2½-in. run-out of the jacks made with the o'd pedestals bolted to

the bottom chord, after the anchor-bolt nuts had been removed. The anchor bolts were then burned off flush with the grillage, the pedestal lowered to rollers on the grillage and removed. The top of the rocker shoe, which is recessed for bolts, was then attached to the bottom chord, and the lower portion of the shoe attached to the top by means of sliding plates. The height of the rocker shoe thus assembled equals the depth of the pedestal which it replaced. A further run-out of 4 in. was made, 6-in. castings were placed beneath the rocker shoe and the jack



INSIDE NEW BRIDGE SUPPORT with all steel in place and grout poured in wells and castings. Anchor pin at base of castings was made to enter top of original grillage.



FINISHED STEEL SUPPORT for bridge, as seen from river side. Original shoes have been set back in their normal place in lieu of rocker shoes used during erection.

trays, and the weight of the bridge caused to rest thereon. This operation occurred simultaneously beneath the main trunnion and counterweight trunnion.

A further run-out of 9 in. was made, and, when a height of 21 in. had been attained the rocker casting was detached from the lower chord, an iron casting 21 in. in depth substituted, and the rocker casting, in turn, bolted to the underside of this casting. Incident to this change, the capacity of the jacking equipment underwent a severe test, as, during a period of four hours, the entire weight of the bridge rested upon the jacks, during which interval no perceptible recession occurred. After the insertion of the 21-in. casting between the rocker casting and the underside of the bottom chord, a shorter casting of similar depth was attached to the bottom chord immediately over each battery of jacks; these castings were aligned with the long castings over the rocker castings and secured thereto by means of bolts. The raising and lowering of the 300-ton and 500-ton jacks was accomplished by means of track jacks, resting upon the bottom flanges of the bridge, connected to the large jacks by means of cables.

In successive run-outs of the jacks, and the corresponding addition and rearrangement of parts in the articulated substructure, the work proceeded during the ensuing six days, until the de-

sired final elevation was attained April 29, one week after the jacking had commenced. The actual jacking consumed 36 hours. As the raising of the bridge progressed, the supporting columns were built up by the addition of successive castings and stabilized by attachment of structural steel parts. Parallel with the river, beneath the main and counterweight trunnions, this bracing was so disposed as to form a complete web between the supporting columns; parallel with the center line of track it was arranged in the form of stepped counterforts. Around and outside of the structure, timber cribbing was erected to serve the need of a working platform for placing the castings and structural steel, and other operations incident to the work.

The development of plans and procedure for this work was handled by the writer under L. G. Curtis, chief engineer, B.&O.C.T.R.R.. During the field operations, the railroad company was represented by H. D. Clark, field engineer, assisted by H. W. Wilcox, Inspector. The progress photographs, some of which are used to illustrate this article, were made by Mr. Wilcox.

The actual jacking was performed by the Ferro Construction Co. of Chicago, as contractors, using jacking equipment purchased by the railroad company from the Watson-Stillman Co. of New York.



CONCRETE ENCASEMENT around new bridge support, showing old masonry below new.

Construction Sets Quicker Pace at HOOVER DAM



EIGHT-FOOT TUNNEL HEADING has been extended through rock into the canyon wall on the Arizona side of the Colorado River. Ventilating pipe is carried on wall of bore at right.



SCALING LOOSE ROCK from canyon walls. Note, also, wire rope cables for suspension bridges to carry compressed air pipe lines across river.

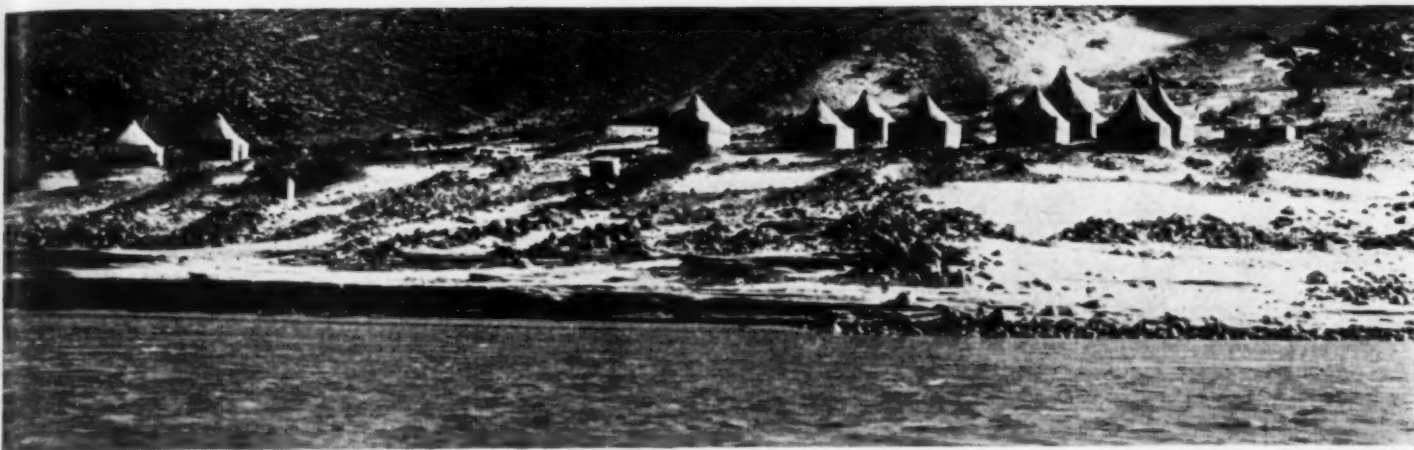
Photos by
W. A. DAVIS
Las Vegas, Nev.



PUMPING STATION is being constructed below outlet of diversion tunnels on Nevada side of river. It will deliver Colorado River water to Boulder City, involving lift of 650 ft.



STEEL PIPE LINE, 10 and 12 in. in diameter, is being laid by Wheelright Construction Co. to carry water 35,000 ft. from Colorado River to 2,000,000-yd. storage tank in Boulder City.



TENT CAMP on banks of Colorado River for workers of Six Companies, Inc., who are engaged in drilling and tunneling the canyon walls for a railroad to deliver sand and gravel and remove tunnel spoil.

Union Pacific Photo.

AIR COMPRESSOR PLANT (below) of three 4,000-cu.ft.-per-minute units is being set up on Nevada side of river below diversion tunnels.



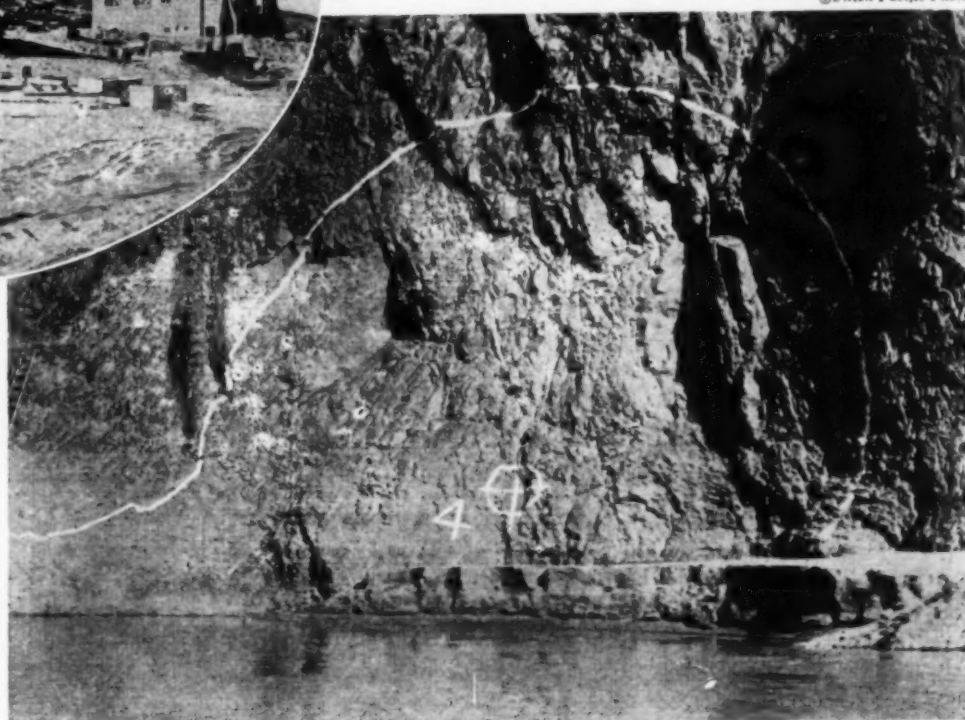
LOOKING UPSTREAM from below the site of the Hoover Dam. In foreground at right, which is the Arizona side, may be seen portal of one of the diversion tunnels.

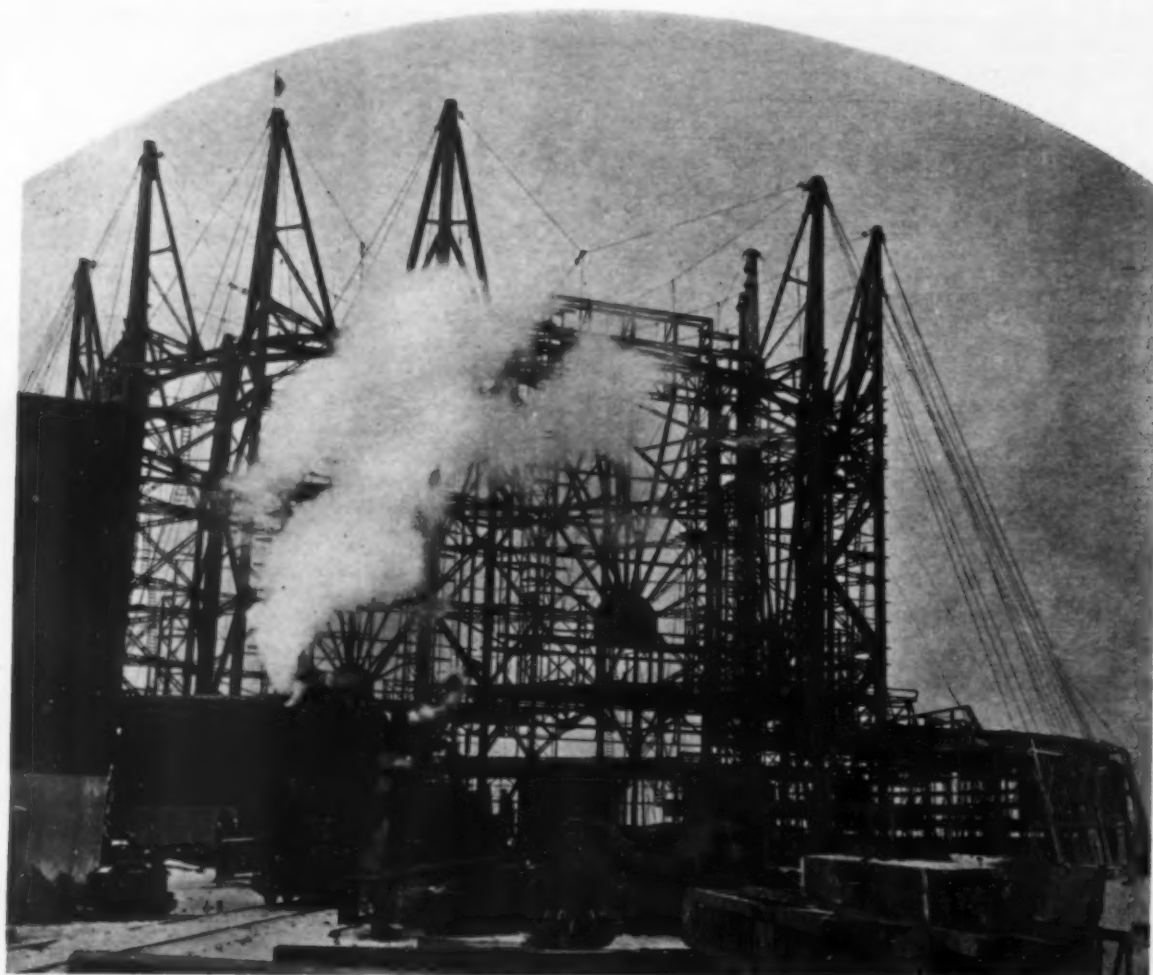
©Union Pacific Photo.



DWELLING HOUSES (above) for Bureau of Reclamation engineers are first brick structures to be erected in Boulder City. Elevated water storage tank in background.

MARKING (right) on canyon walls of Colorado River location of one of the outlets of the four diversion and spillway tunnels.

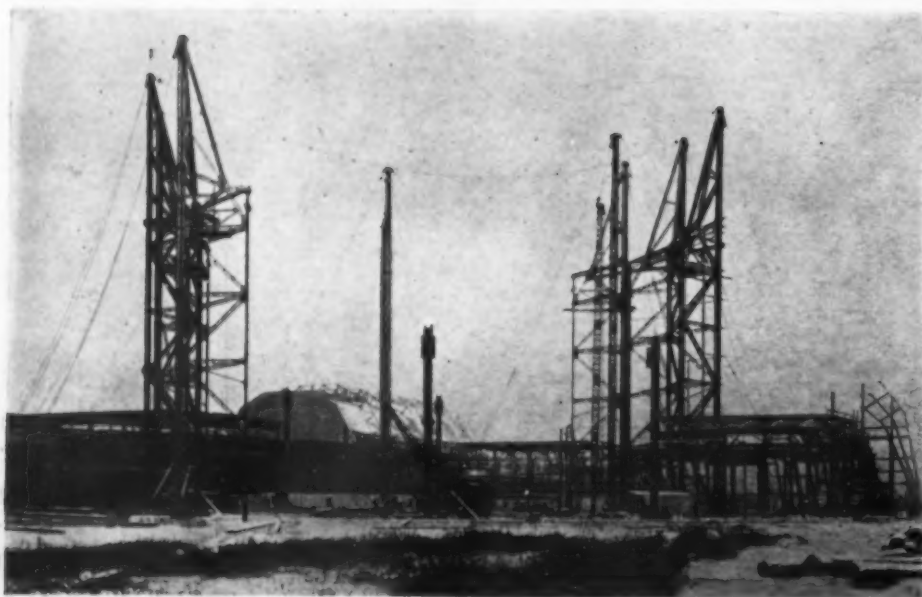




WIRE ROPE CABLES

Support Domed Roof of Chicago Exposition Building

WIRE ROPE CABLES from trussed steel columns support dome-shaped roof, 200 ft. in diameter, for Travel and Transport Building at Chicago's Century of Progress Exposition.



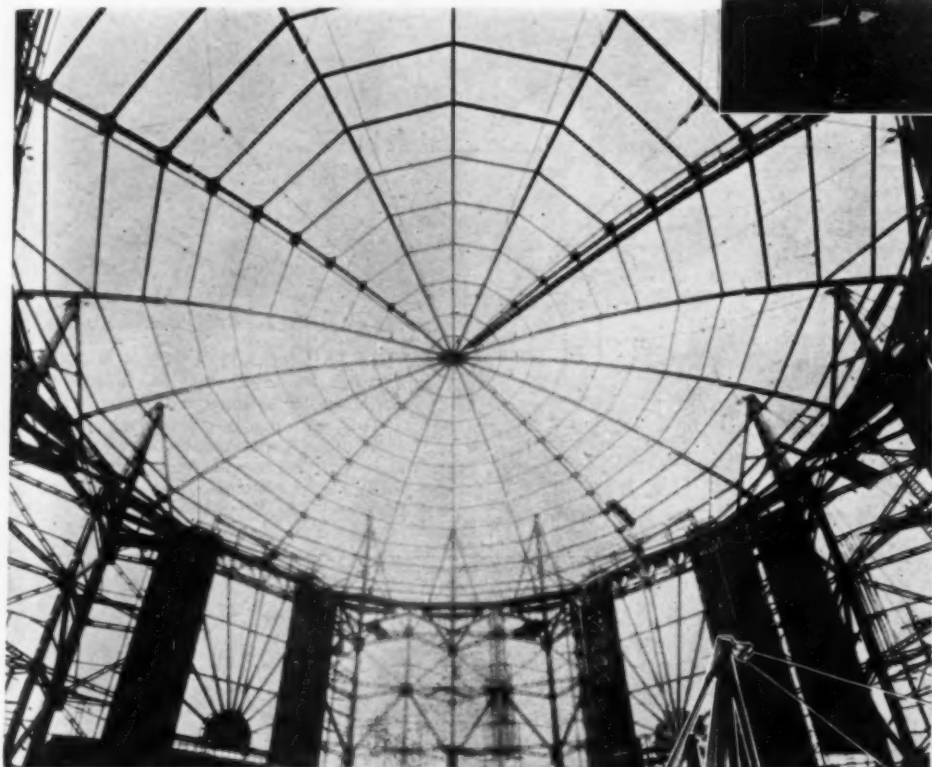
COLUMNS are 150 ft. high and consist of steel I-beams fabricated in section of a cross. Stiffening is provided by trusses on inside. Each tower is mounted on a rocker base.

WIRE suspension cables strung between the tops of trussed steel columns are the novel means employed to support the circular domed roof of the Travel and Transport Building being constructed to house one of the exhibits for Chicago's Century of Progress Exposition, to open June 1, 1933. The dome of the structure, suspended by vertical hanger rods spaced 16 ft. apart along the suspension cables, covers a circular building with an inside clear height of 125 ft. and a diameter of 200 ft. The twelve columns carrying the roof cables are each 150 ft. high, arranged in groups of three at each quadrant and are supported by rocker bearings at equal distances around the circumference of a 212-ft. circle. In a 300-ft. circle concentric with the ring of columns are anchorages for the column backstay cables. The general effect sought for in the design of the struc-

ture is that of a railway roundhouse, with tracks inside radiating from a central turntable for the exhibit of locomotives.

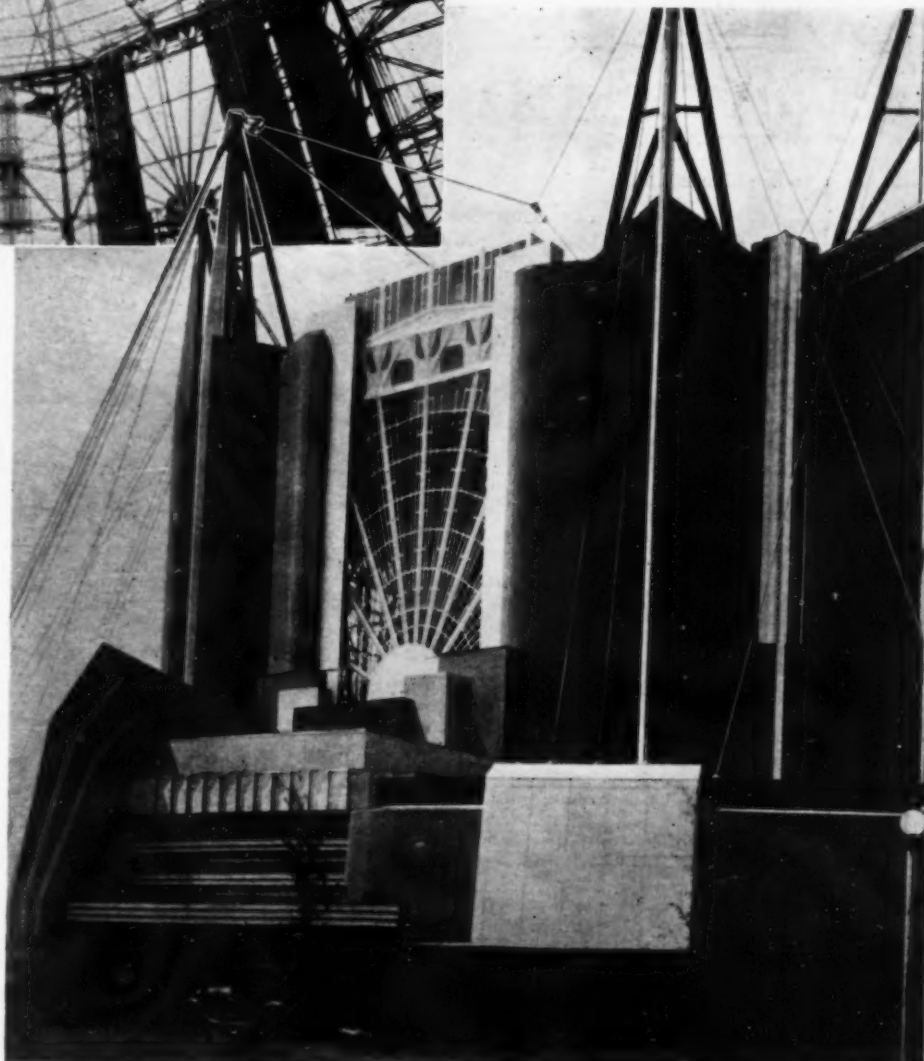
Each of the cable-carrying towers has a main column fabricated of two small steel I-beams with their flanges riveted to the web of a large main I-beam producing the section of a cross. The main column is trussed on its inner side to create the required stiffness. Wing gusset plates at the heads of the columns provide means for

ROOF SUPPORT (right) is by means of vertical hangers spaced at intervals of 16 ft. along the main suspension cables.



DOMED ROOF (left) is built of radial 16-in. steel I-beams curved vertically to rise 19 ft. and connected by I-beam purlins.

BACKSTAY CABLES (below) at inclination of 70 deg. with horizontal extend from column tops to concrete anchorages.



the attachment of the suspension cables of the domed roof and the backstay cables, both supplied by the American Steel & Wire Co.

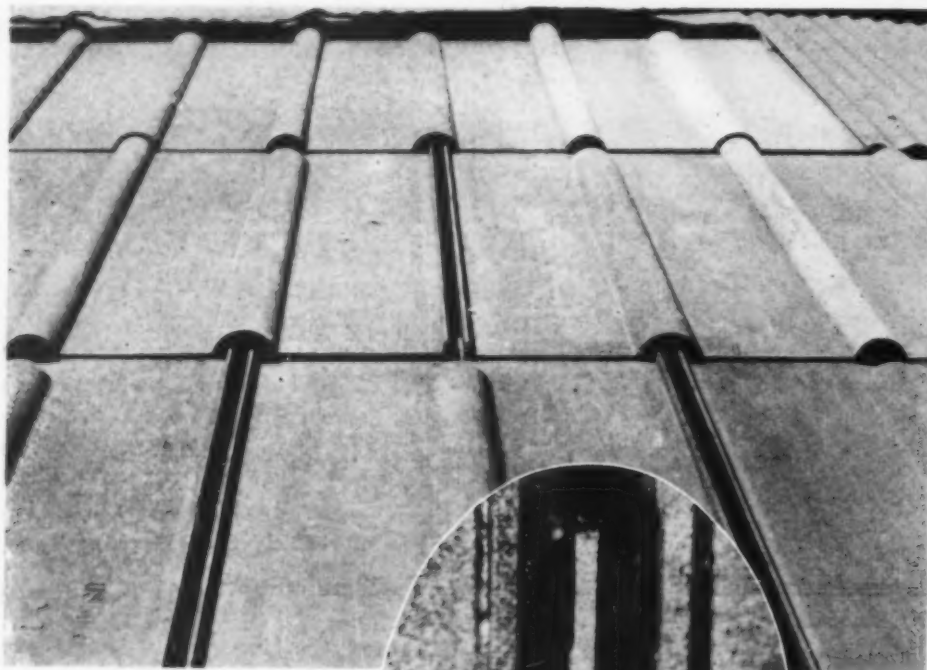
For the dome the framing consists of radial 16-in. I-beams curved vertically to a rise of 19 ft. and connected by I-beam purlins. This framing supports a deck of Holorib light cold-rolled steel channels.

For supporting the dome-shaped roof 1½-in. suspension cables extend between pairs of columns with a sag of 25 ft. Vertical hanger rods extend from each cable to the roof. Backstay cables are at an angle of 70 deg. from the horizontal, this steep inclination necessitating 2½-in. cables. Each anchorage is a 30x21-ft. concrete block, 9 to 11 in. thick, with a steel anchor frame imbedded in it.

The unusual building was designed by a board of architects comprising E. H. Bennet, H. Burnham and J. A. Holabird. Daniel H. Burnham is director of works and John Griffith & Son Co., the contractor.

NEW EQUIPMENT

on the Job



CAST-IRON PLATE ROOFING for heavy service roofs consists of plates 2 ft. wide, 4 ft. 4 in. long, $\frac{1}{2}$ in. thick, each weighing 78 lb. Semi-cylindrical rib extends along center of each plate. Two lateral edges of plate have upward extending rib 1 in. high from end to end. Stop on either side of top edge holds plate in place between purlins. Longitudinal joint between adjacent plates is covered by semi-cylindrical casting whose lower side has a lug near bottom and which passes down between edges of two roofing plates and receives wedge key (*in oval*) passing under top flange of the I-beam or channel purlin on which plate rests. Key locks strip securely in place. Second course of roofing plates is staggered, middle rib of upper course lapping over capping strip at joint of plates in course below.—U. S. Pipe and Foundry Co., Burlington, N. J.



REDUCTION IN DEAD WEIGHT (*left*) by air-cooling and modern automotive-type engineering design enables 320-cu.ft. air compressor to be transported easily over rough country. Elimination of water-cooling parts simplifies construction. Division of compressor load over four cylinders instead of two provides smoother operation with less wear and tear on compressor and engine. Mounted on steel treads or rubber tires and on skids for motor truck.—Davey Compressor Co., Kent, Ohio.



CONCRETE VIBRATOR for settling and compacting dry concrete. Made in two types, one to be used on flat slabs, beams or girders, and the other to be clamped on walls, mass concrete or concrete product forms. Equipped with air-driven, eccentric rotor controlled by amount of air pressure.—A. W. Munsell, 999 West Side Ave., Jersey City, N. J.

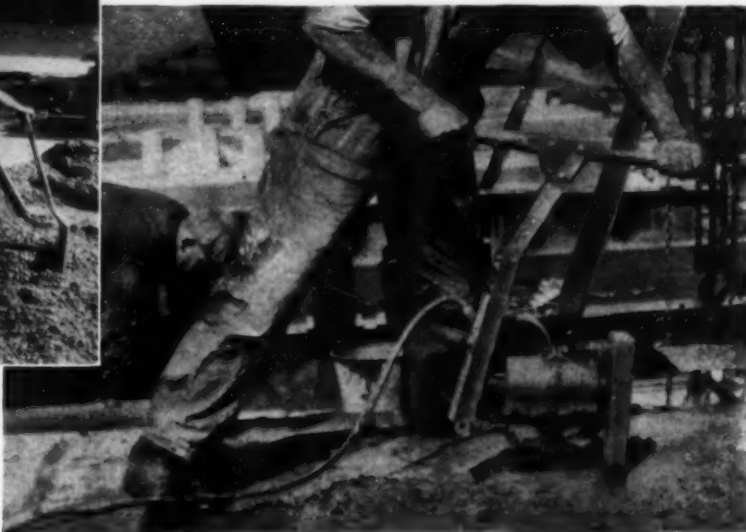


AUTOMATIC GRAVITY TRACTOR DUMP UNIT for use in earth-moving. Struck capacity 3 cu.yd., or 5 cu.yd. with sideboards. Supplied with crawler mounting or on steel or pneumatic-tired wheels. Body dumps by gravity and is fitted with two spring-mounted chains to absorb shock of dumping. Dual control arrangement with an operator's seat facing in each direction assures ease of operation. Bulldozer attachment, auxiliary equipment. Power unit, McCormick-Deering 10-20 tractor.—Shunk Manufacturing Co., Bucyrus, Ohio.



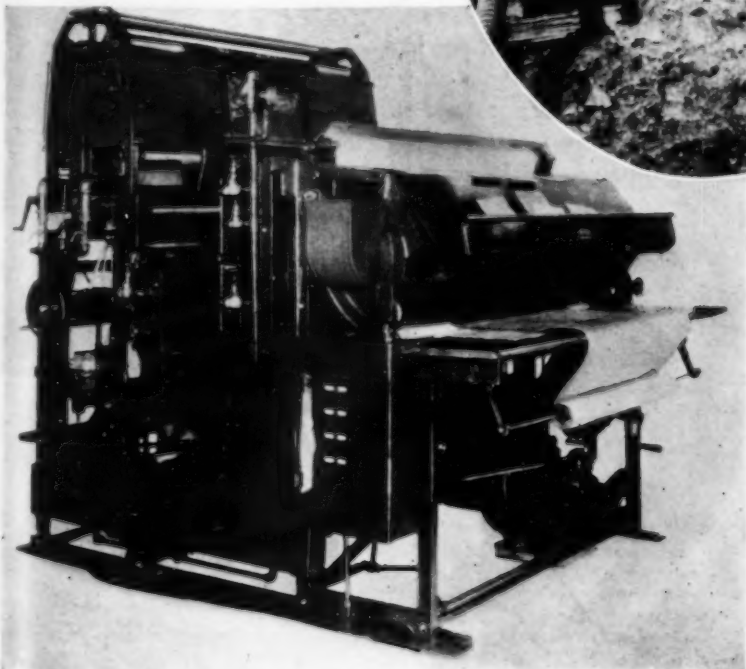
TRUCK MIXER AND AGITATOR has five-step mixing action accomplished by clockwise rotating and without reversing direction. Egg-shaped drum with twelve-sided panel design. Full control of discharge—fast, slow or intermittent. Positive discharge—no hoisting or tilting of drum. Adaptable to any make of truck. Separate power unit. Roller and ball-bearing drum support. Two sizes: 1—1½ cu.yd. has capacity of 1 yd. as mixer and 1½ yd. as agitator; 2—3 cu.yd. has capacity of 2 cu.yd. as mixer and 3 cu.yd. as agitator.—National Equipment Corporation, Milwaukee, Wis.

CONCRETE VIBRATOR (below), electrically operated, eliminates hand spading and rapping of forms. Aids distribution of dry concrete around structural and reinforcing members. Shown with spud attachment for bridge deck and floor construction. Consists of semi-rigid handle, attached by ordinary rubber or canvas belt to top half of motor case, which enables operator to hold machine and escape its vibration. To bottom of motor case is bolted a wood or metal spud which goes between reinforcing members and reaches form.—Electric Tamper & Equipment Co., 400 Madison St., Chicago, Ill.

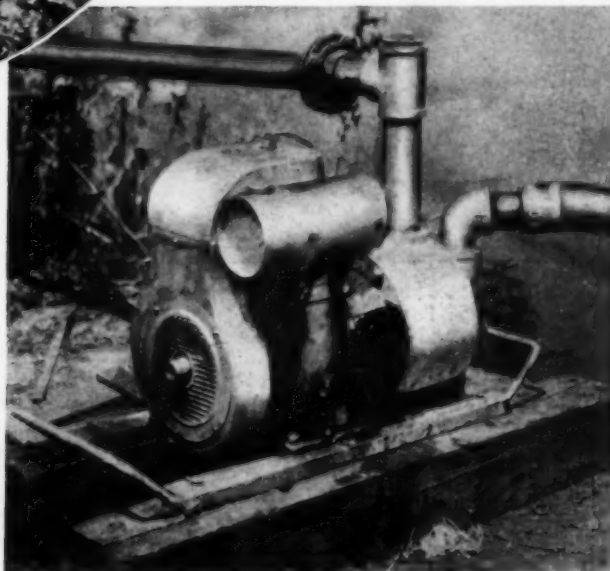


SELF-PRIMING CENTRIFUGAL PUMP (left), a self-contained unit capable of priming itself whenever necessary and providing all suction lifts attained by centrifugal pumps. Has steel impeller of open type, making it possible for pump to handle large portion of solids, such as sand, gravel and silt. Self-cleaning. Built in 3-, 4- and 6-in. sizes, with capacities ranging from 400 to 1,400 g.p.m. Truck or skid mounted.—Novo Engine Co., Lansing, Mich.

BLUE PRINTING EQUIPMENT (below) designed to meet demands of moderate budget. Composed of three units—blue-printing machine, washing machine and potashing, washing and drying machine. All units made in two sizes, 42 in. and 54 in. wide; can be used to operate on 220 volts, d.c. or a.c.—C. F. Pease Co., 813 N. Franklin, Chicago, Ill.



AUTOMATIC, POSITIVE PRIMING CENTRIFUGAL PUMP (below) discharging water through 500 ft. of 3-in. line on a road construction job near Oklahoma City, Okla., Union Construction Co., contractor. Suction lifts up to 29 ft. Pumps air or water or mixture of air and water. Crankshaft mounted on Timken roller bearings. Vertical single-cylinder air-cooled four-cycle engine developing more than 5 hp. at 1,800 r.p.m. Capacities, 10- to 90-ft. heads, 18,960 to 2,760 gal. per hour.—Sterling Machinery Corp., 2303 Holmes St., Kansas City, Mo.



Present and Accounted For —

A Page of Personalities



E. J. MEHREN, formerly vice-president and editorial director of the McGraw-Hill Publishing Co., resigned Sept. 1 to become president of the Portland Cement Association. Mr. Mehren for many years served as editor of *Engineering Record* and of *Engineering News-Record*. In appointing Mr. Mehren, the Portland Cement Association for the first time has gone outside the ranks of the cement manufacturers for its executive head.

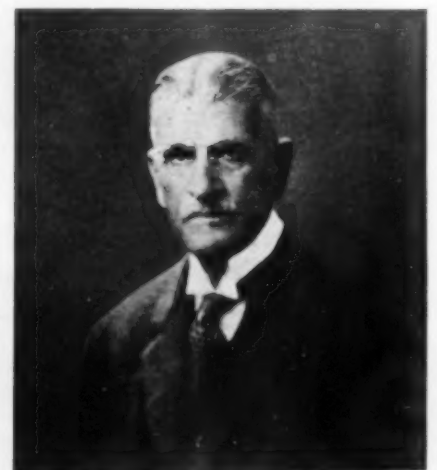


JOSEPH A. TOMASELLO, member of the firm of A. G. Tomasello & Son, Inc., general contractors of Boston, Mass., is serving a second term as president of the New England Road Builders' Association. Last month the Italian Consul at Boston, on behalf of the King of Italy, decorated Mr. Tomasello as Knight of the Order of the Crown of Italy.



O. H. AMMANN, chief engineer of the Port of New York Authority and designer of the Hudson River bridge with a main cable suspension span of 3,500 ft., has received from New York University the honorary degree of Doctor of Engineering.

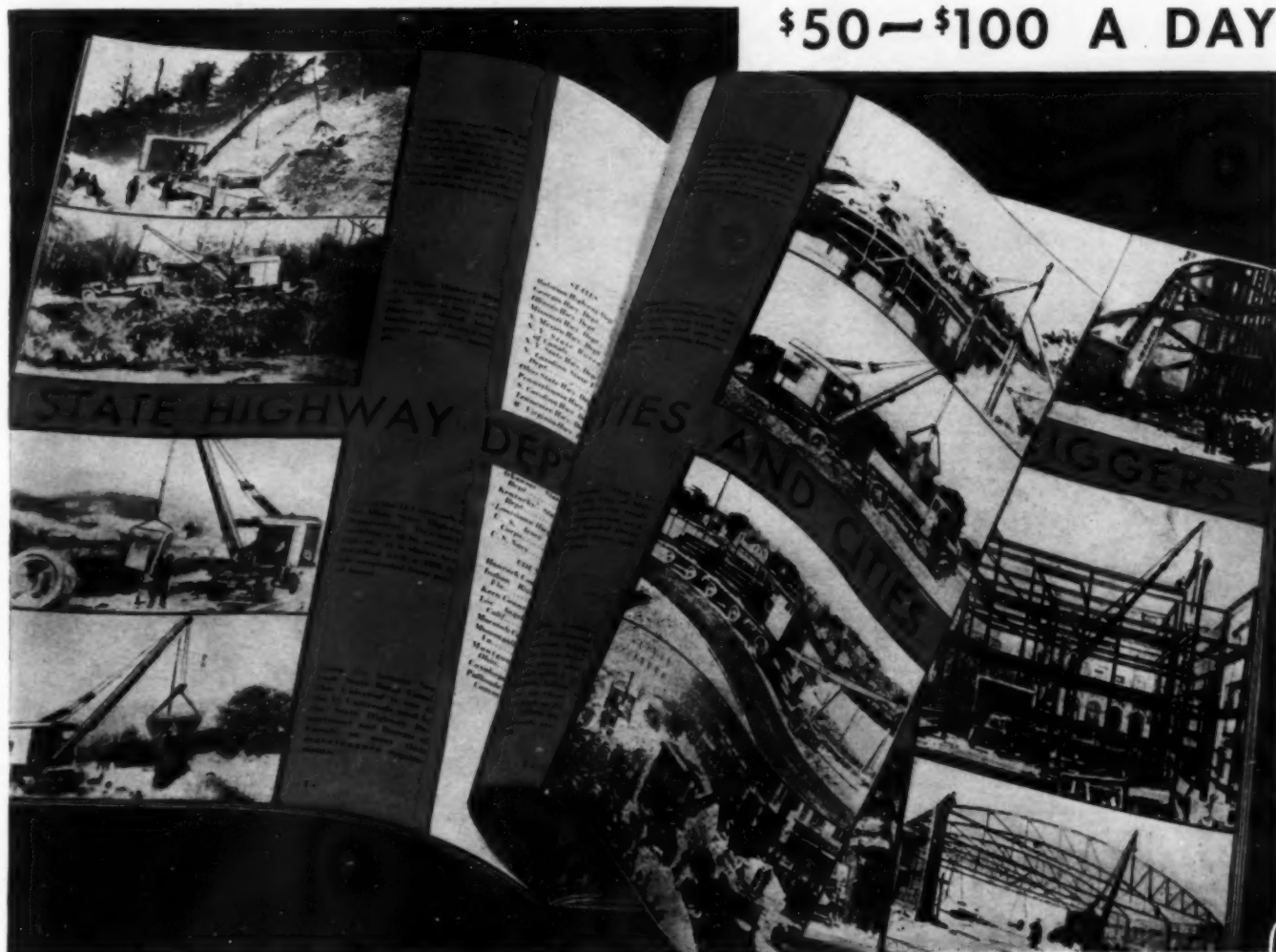
F. C. BRETZ (*below*), of Ayrshire, Ia., in spite of the handicap of blindness resulting from an explosion of dynamite two years ago, is carrying on his business as a road-building contractor. At the present time he is handling a 5½-mile grading job in Iowa, involving 122,000 cu.yd.



M. S. BLAIKLOCK, after more than 50 years of service, has retired as assistant chief engineer of the Canadian National Railways. He retains his position as chairman of the general co-operative committee of maintenance-of-way employees.

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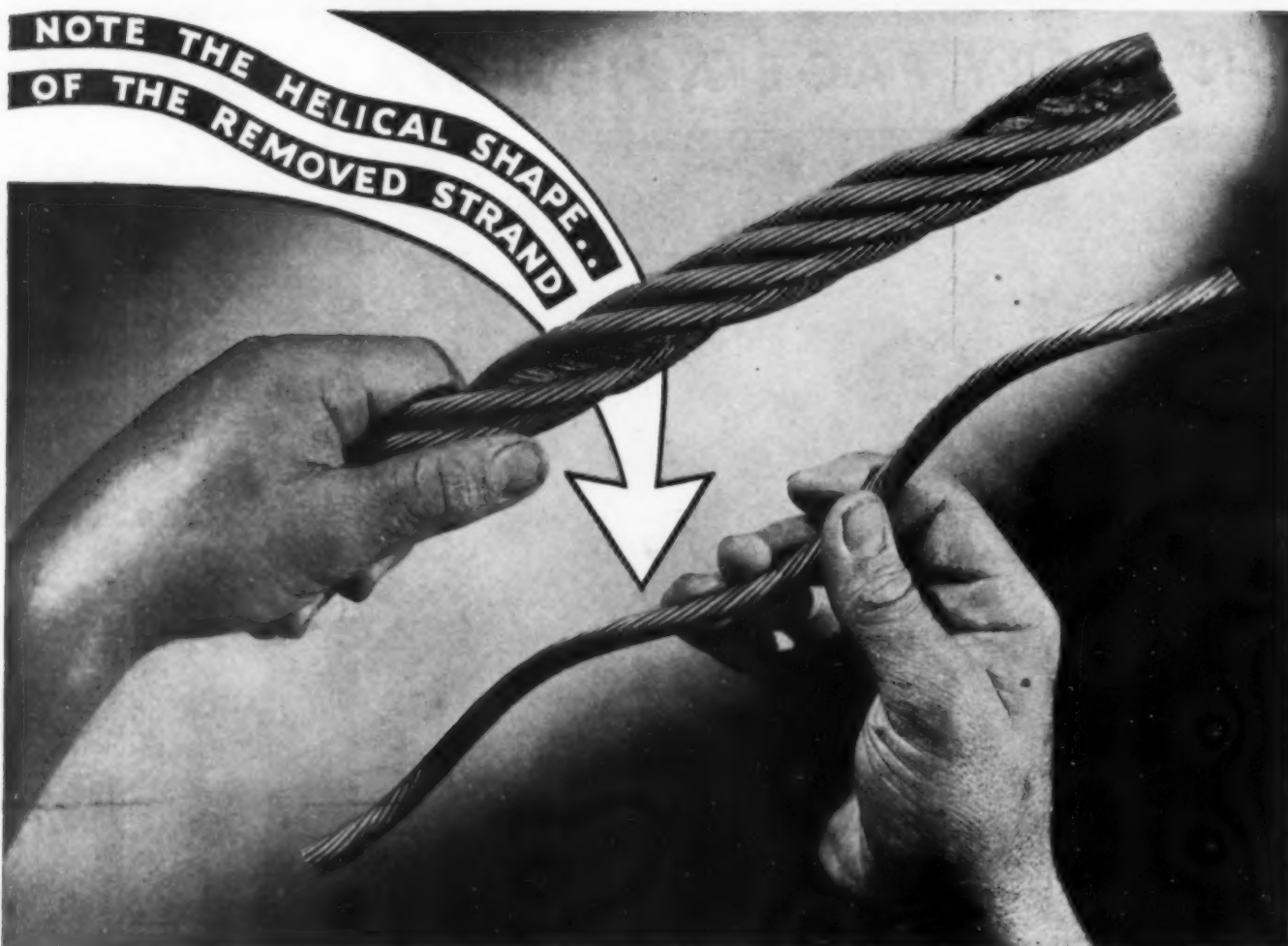
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Elimination of internal stress in Lay-Set Preformed Wire Rope adds 30% to 300% *additional service*, which varies, depending upon the character of the service and type of equipment. Lay-Set is particularly efficient on power shovels, cranes, drag lines and similar equipment which is as a rule severe on wire rope.

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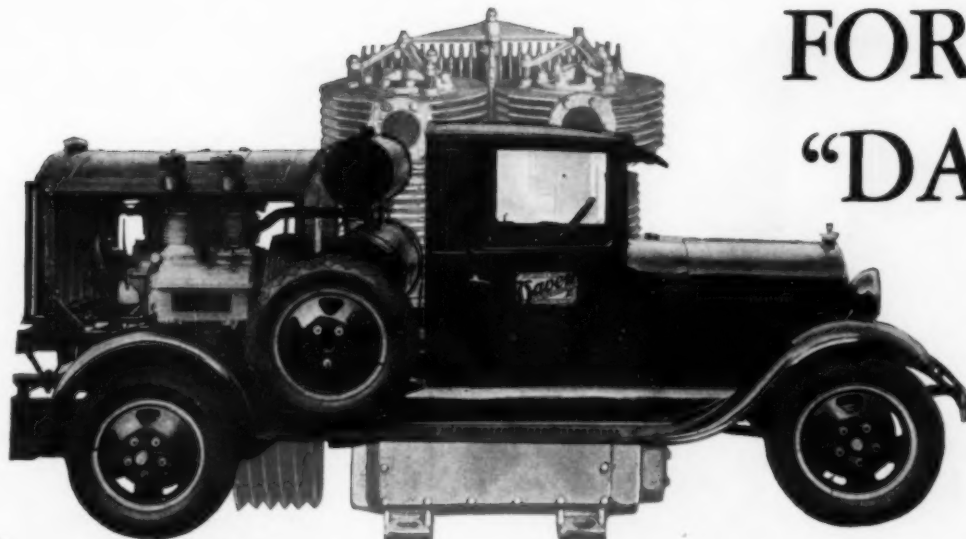


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FORD *and* "DAVEY"

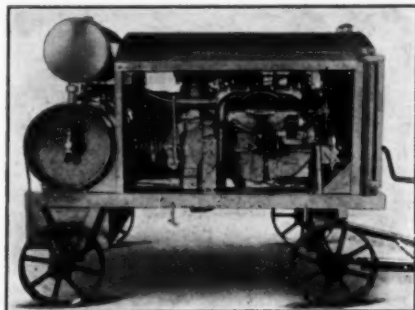
The method of cooling air compressors through the use of metals of high heat conducting quality and capacity, as contained in Davey Compressors, is fully protected by patent.

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and compressor performance . . .

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BY THE FORD INDUSTRIAL MOTOR



Wherever you need a dependable supply of compressed air, you get it quicker and cheaper from this Ford-powered Davey Compressor mounted on a standard Ford short wheel-base chassis. This combination outfit goes wherever you can drive a Ford car—gets there quick, starts with a twist of the crank, or the turn of a self-starter switch, and settles down to pumping air with the throw of a clutch.



Its extraordinary mobility is due to its light weight. The full-size 110 cu. ft. Davey Compressor unit uses aluminum alloys for the finned compressor heads and manifolds. This eliminates heavy cast-iron water jackets and other cooling paraphernalia. Hence the complete compressor outfit weighs fully 600 lbs. less than water-cooled combinations of similar capacity.

"Air-cooling," which retards carbon formation, is responsible for the Davey Compressor's 5-year reputation for sustained efficiency. The Ford Model "A" Industrial

Motor is famous everywhere for dependability and economy. Your engine maintenance problem is simplified through inter-changeability of parts between truck and compressor motors; Ford repair part service is available through 8500 distributors.

This same Ford-powered Davey Compressor is also available in skid-mounted form for use on your own truck, or may be had as a 4-wheeled trailer.

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it, are enthusiastic about the possibilities it brings for added usefulness for air in construction and maintenance work. Be sure to see this Ford-powered Davey Compressor and get all the details.

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Lackawanna Piling Section AP 16

used as cut-off wall and forms
for the foundation of the
Salt Lake City Post Office

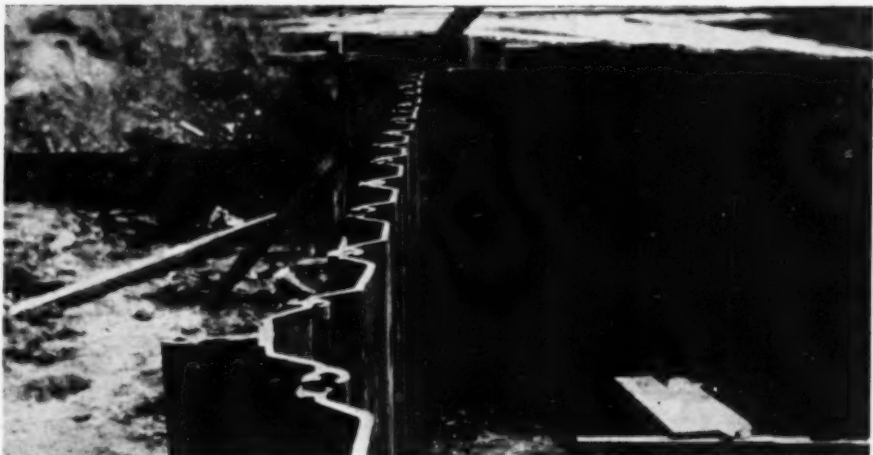
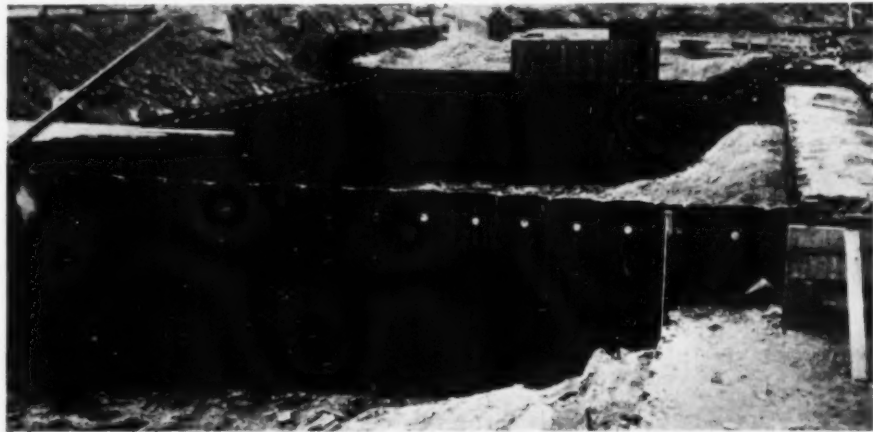


T. C. Rowland, Contractor,
Salt Lake City

The illustrations show the perfect alignment obtained by the use of this piling. Its reversed interlock, an exclusive feature of Lackawanna Section AP 16, permits installation with all of the arches on the same side of the piling wall *without impairing the interlock strength*. This facilitates lining up of the piling wall in driving so that alignment is easily maintained.

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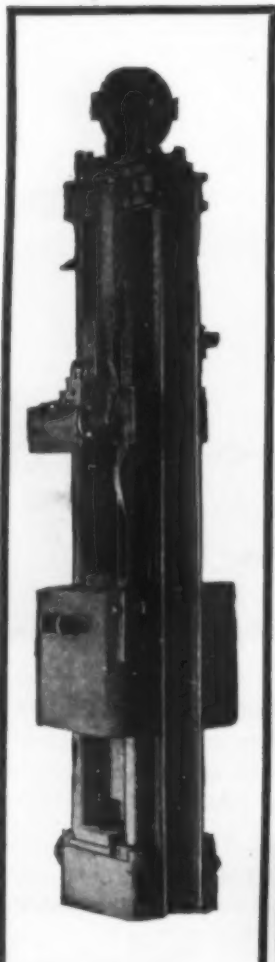
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Warrington-Vulcan

AND THE VULCAN EXTRACTOR TO PULL THEM

WE'RE THE BIRDS WHAT KNOWS A WRENCH!



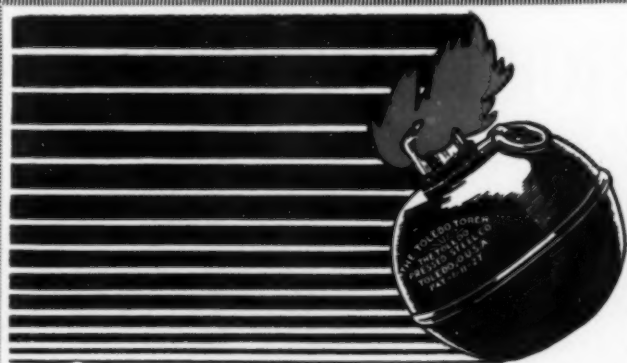
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Put your beef on the Butt end of one of these tools Boy—and any joint's gotta be tight.

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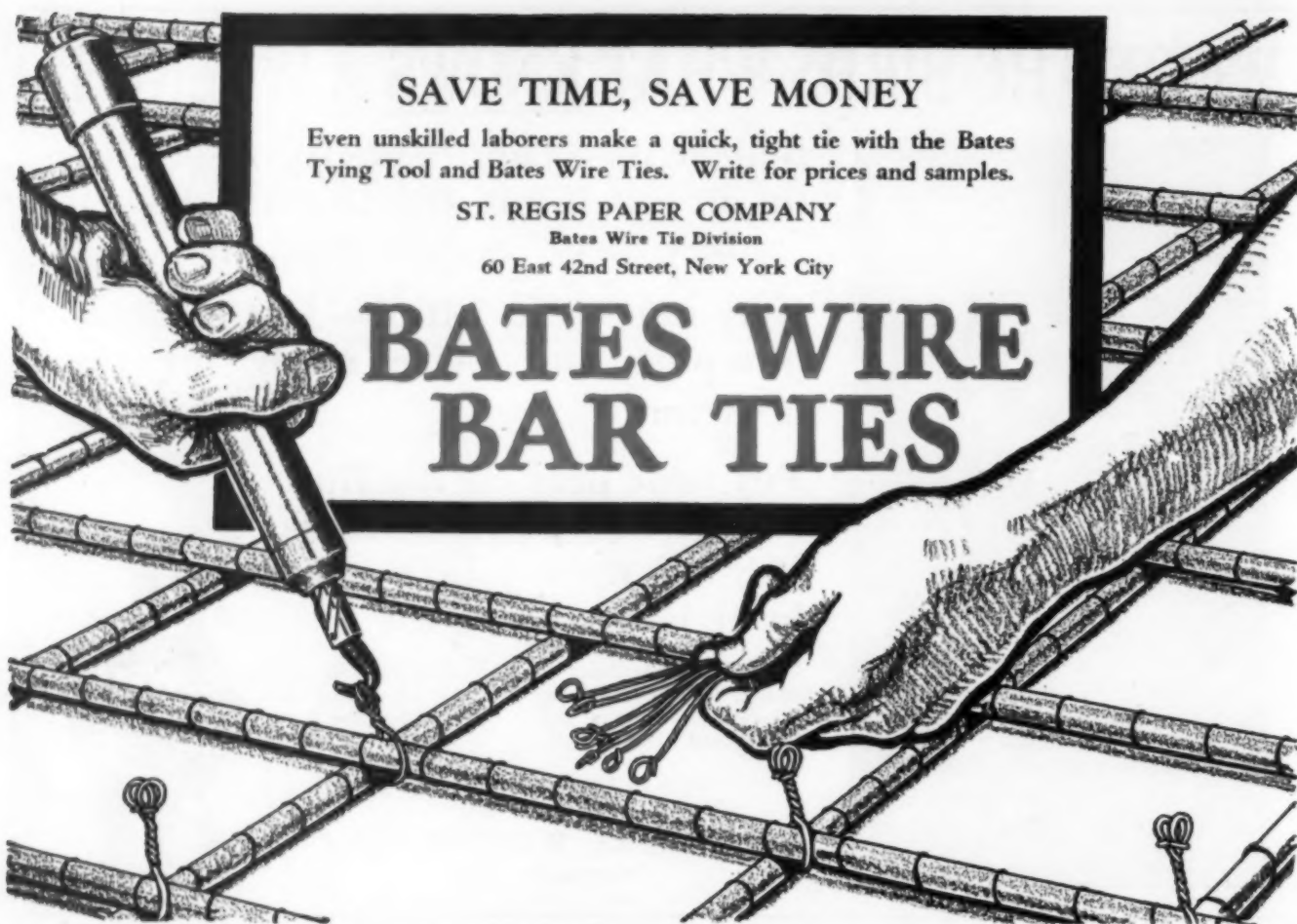
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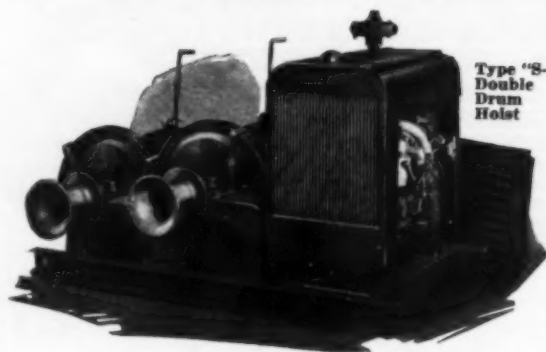


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No. 12 of a series of advertisements on "How Superlative Quality is Built into Roebling Wire Rope"

World's largest rope-making machine

"World's Largest" does not begin to reveal the capability or tremendous capacity of this giant — a Roebling machine that takes huge strands of steel wire and "lays" them into finished rope.

In rope diameter, the capacity of this machine is practically unlimited. It can make ropes of a diameter far beyond commercial use. In fact, about its only limitation is a capacity to turn out a maximum of 80 tons in weight of rope *in a single length* without reloading. And such a load exceeds the normal capacity of carriers.

This "closing machine", one of many of various types used by Roebling, is an excellent example of Roebling's unsurpassed rope-making facilities.

With such a machine, rope of the largest diameters can be handled without the slightest danger of over-stressing. The result is higher rope efficiency, higher all-around quality.

Incidentally, all the large suspender ropes for the famous George Washington Memorial Bridge, spanning the Hudson River, were made in the machine shown.

ROEBLING



"BLUE CENTER"
STEEL

WIRE ROPE



All work of designing, engineering and constructing the Salt Springs Dam was done by the Architectural and Engineering Department of the Pacific Gas and Electric Co.

Building the great Salt Springs Dam

HERE at Dead Man's Flat on the north fork of the Mokelumne, near California's historic Salt Springs, 3,000,000 cubic yards of granite have been blasted off the sheer walls of the gorge and piled up across the stream into a massive, "concrete-skinned" barricade. It is 330 feet high, 900 feet thick at the base, 1300 feet long at the crest and has an upstream face area of 10 acres. A 920-acre lake is impounded by this great rock-fill dam—the first project in the new hydro-electric development of the Pacific Gas & Electric Co.

The racking work of handling this huge quantity of granite—of conveying the heavy blocks of rock to their places in

the dam—called for wire rope that could take exceptional punishment—and keep on taking it. With so much equipment in use, rope failures—costly breakdowns and delays—had to be guarded against in every possible way. To use rope of superlative quality and great stamina was common sense under the circumstances.

At Salt Springs Dam more than 32 miles of Roebling Steel Wire Rope were used on shovels, cranes, derricks, and cableways.

JOHN A. ROEBLING'S SONS CO., TRENTON, NEW JERSEY

WIRE...WIRE ROPE...WELDING WIRE...FLAT WIRE
COPPER and INSULATED WIRES AND CABLES
WIRE CLOTH and WIRE NETTING

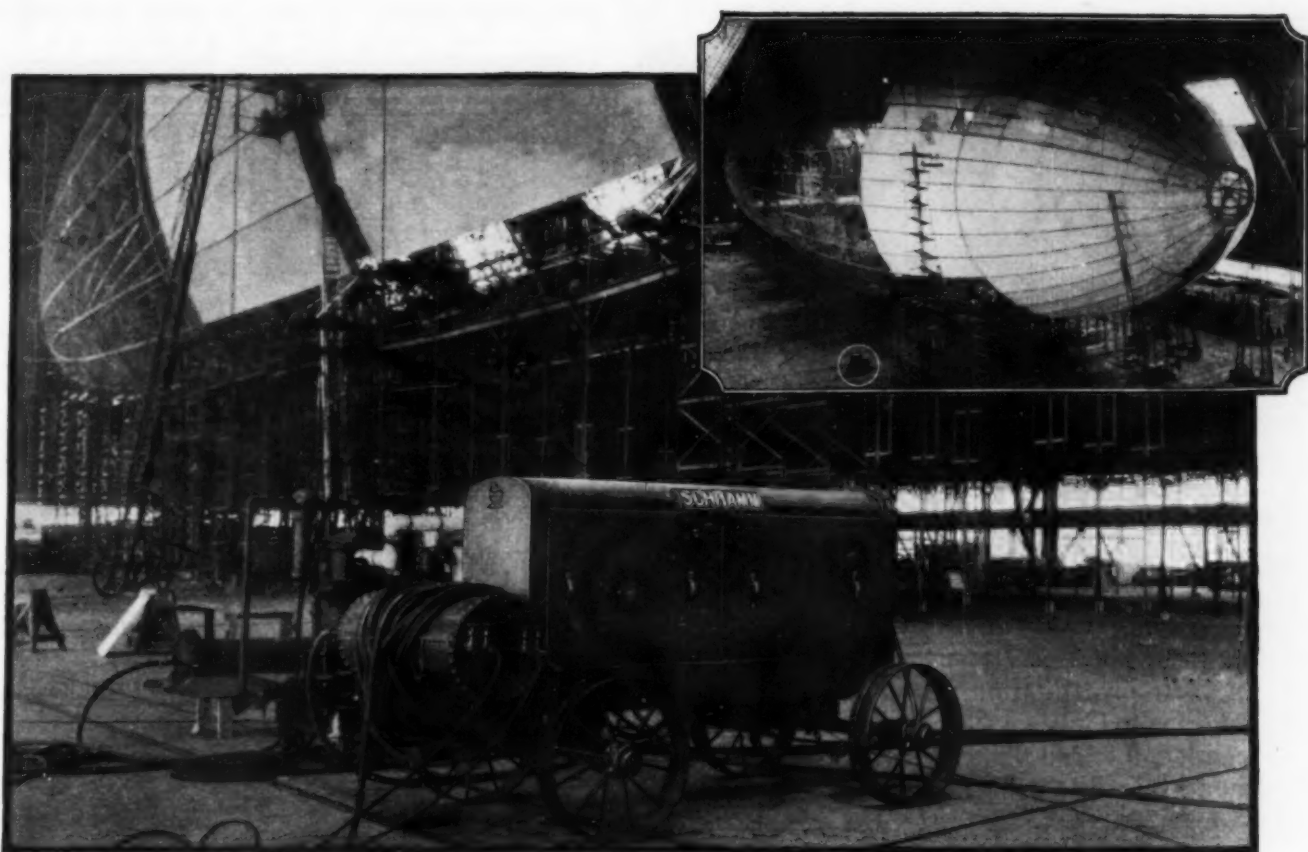
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ROEBLING



"BLUE CENTER"
STEEL

WIRE ROPE



The finishing touch to the World's "giant of the Air"

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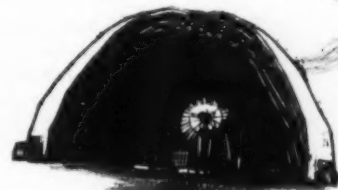
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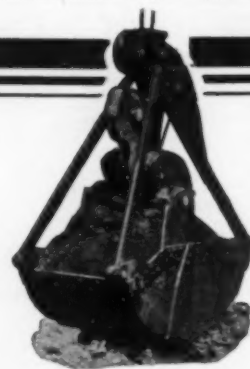
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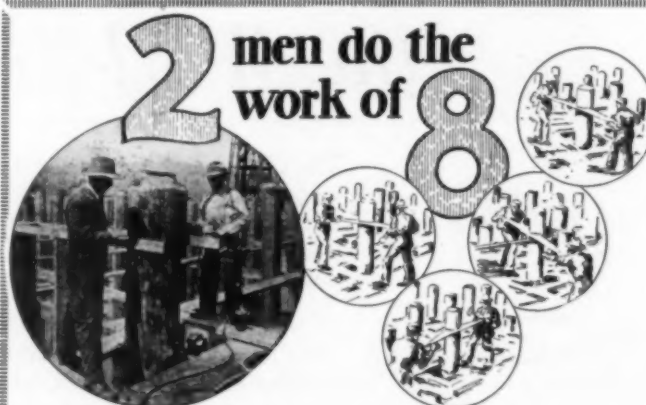
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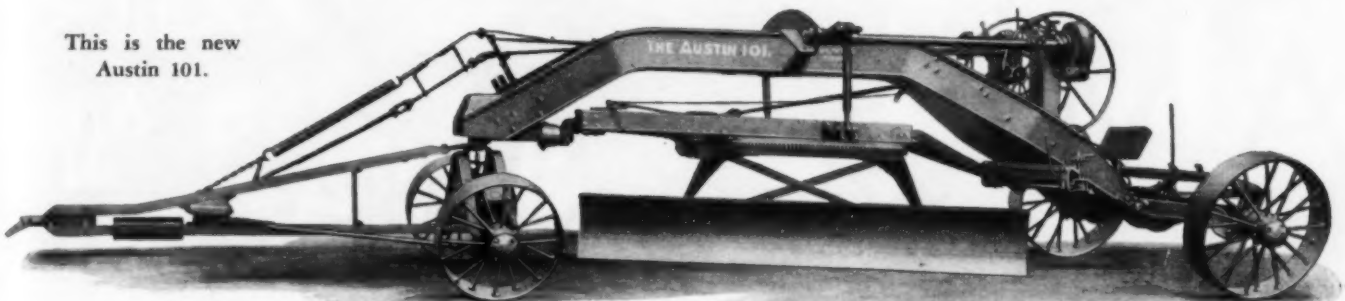
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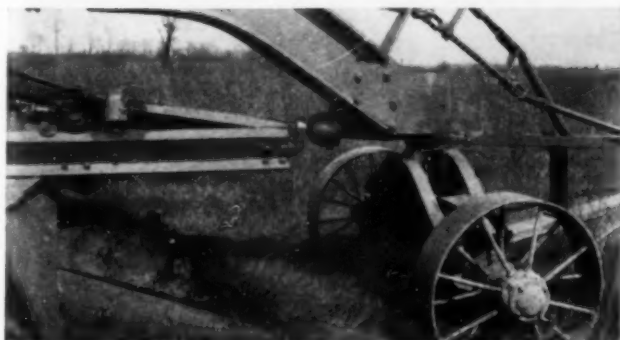
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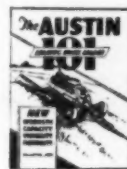
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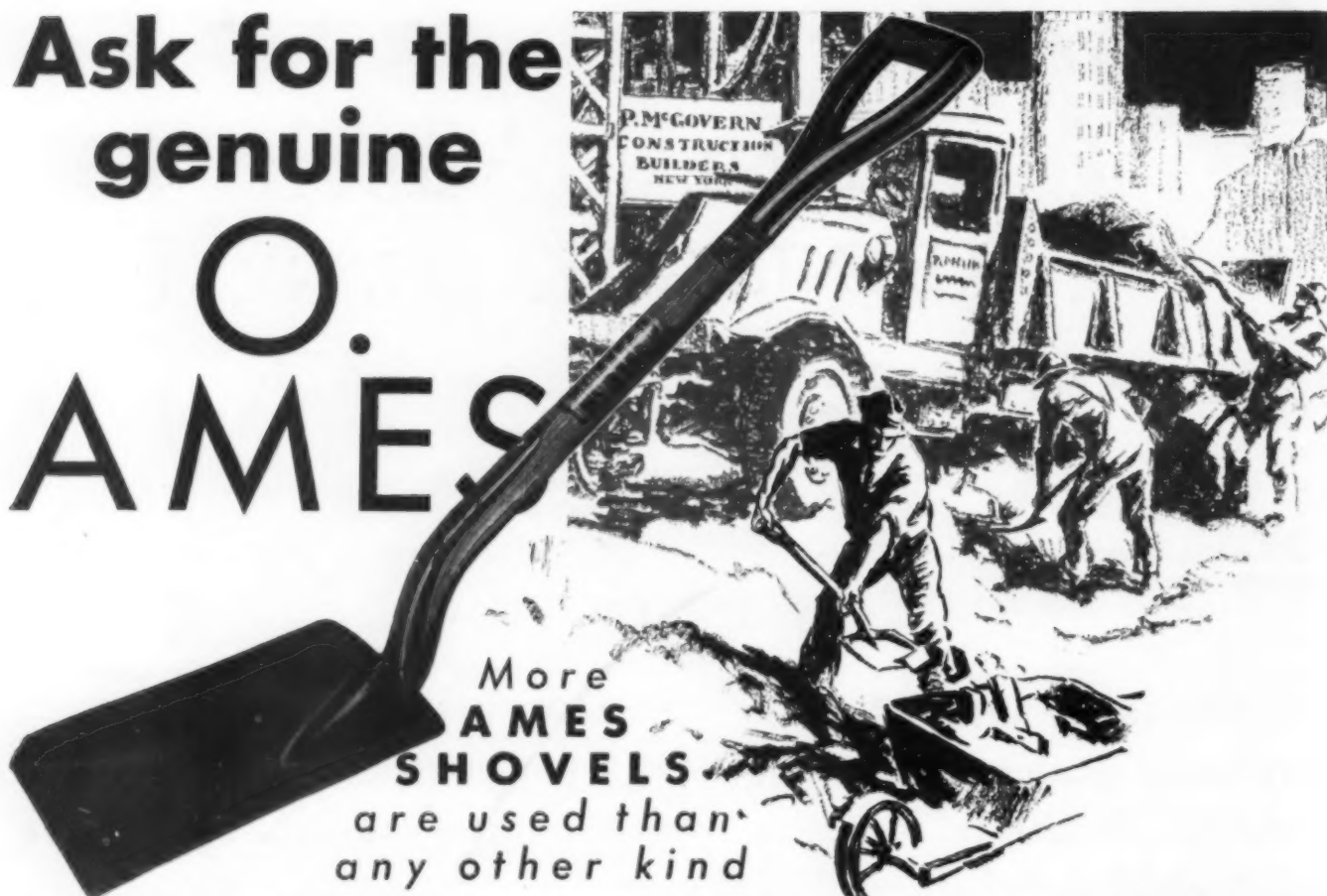
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3 BAY CITY MODEL R 3/4 yd. SHOVELS *installed in June* *for* WARREN COUNTY *New York*

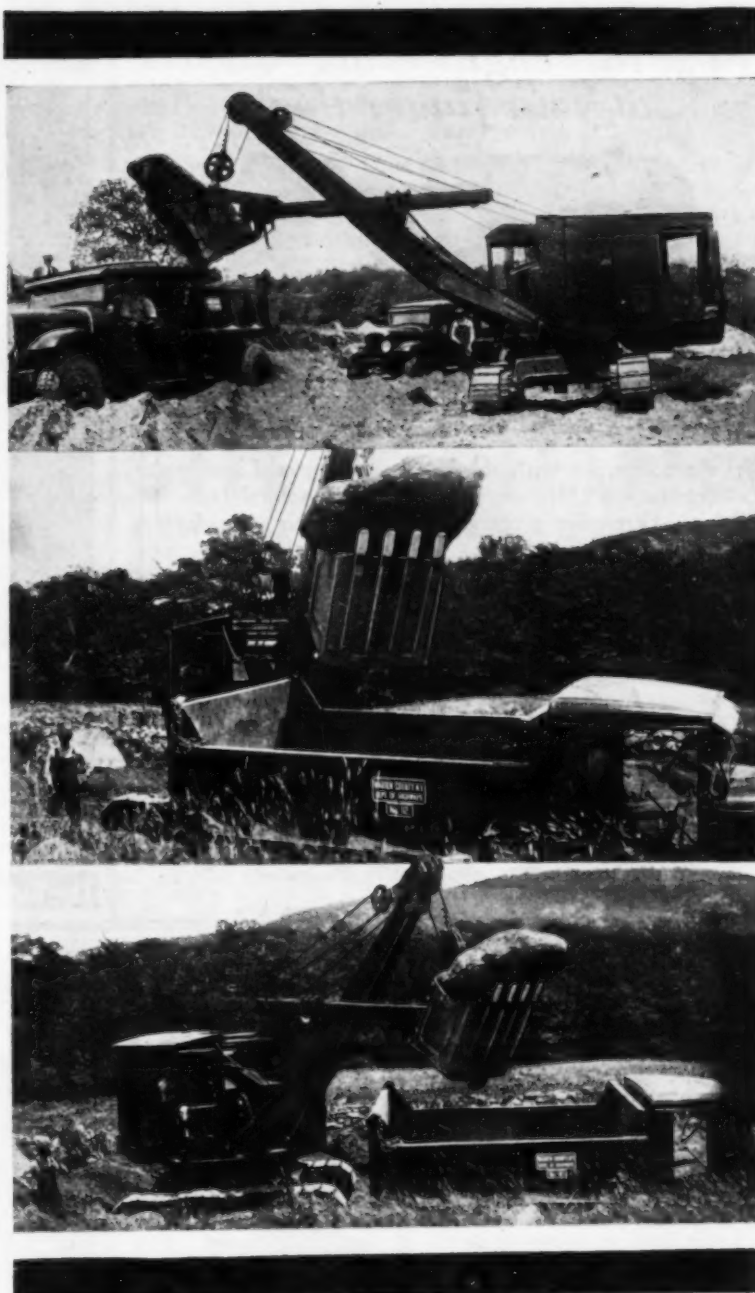
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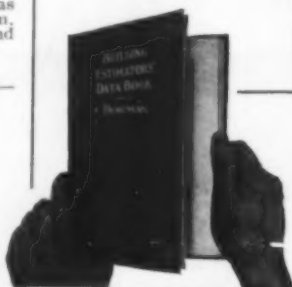
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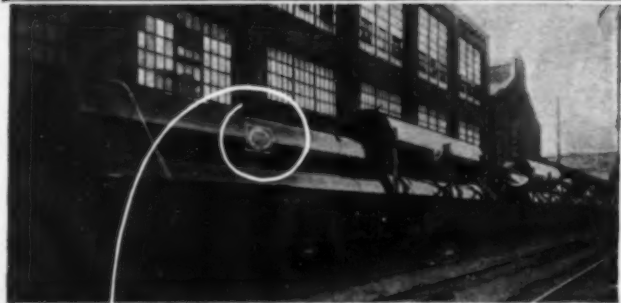
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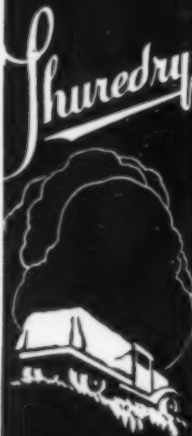
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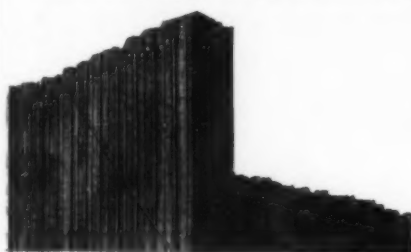
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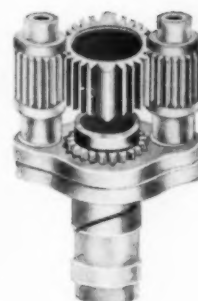
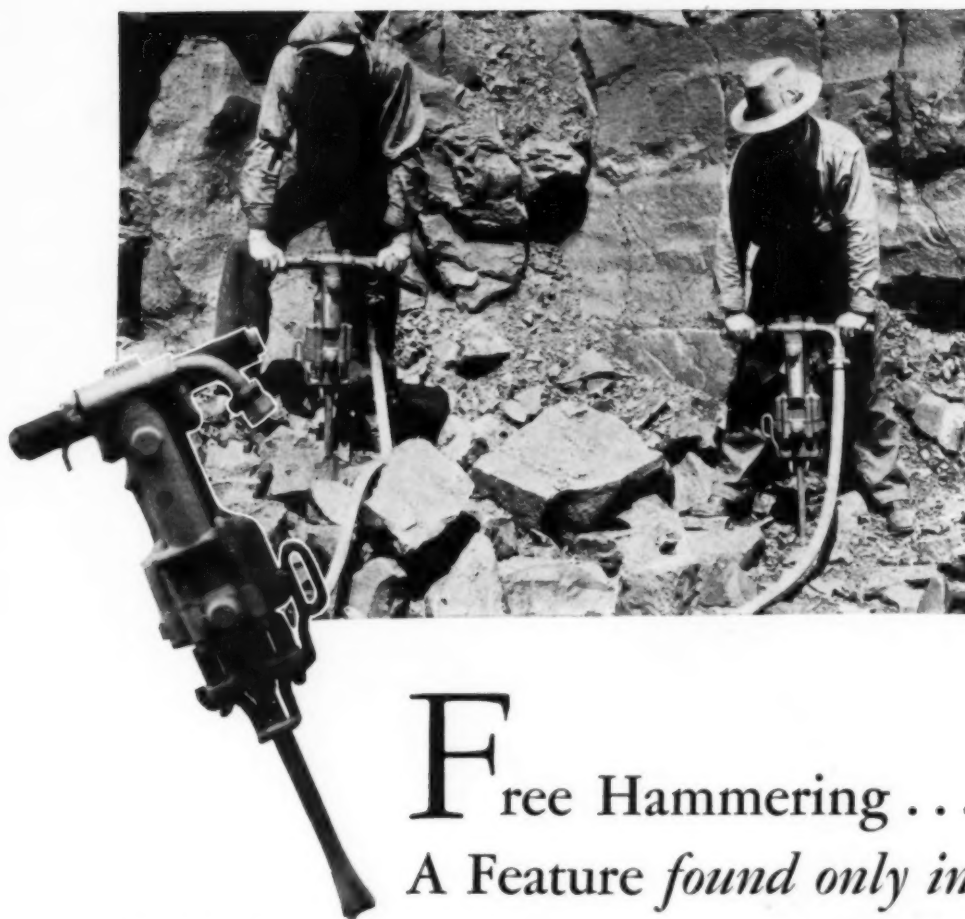
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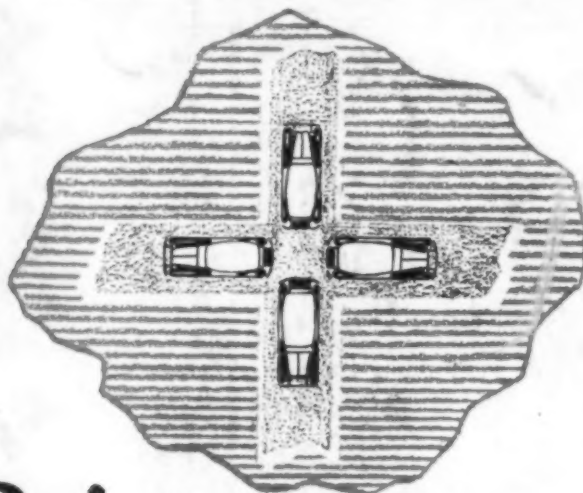
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